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NATURE STUDY

BY GRADES

TEACHERS' BOOK FOR PRIMARY GRADES

BY

HORACE H. CUMMINGS, B.S.

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UNIVERSITY OF UTAH

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NAT. STUDY

W. P. I

PREFACE

THE reason for offering to teachers and students this work on Nature Study is best found in the history of its production. It is now more than a decade since the author took charge of the nature study work in the State Normal School of the University of Utah. As no text-book could be found at that time suitable to the environment of the pupils, and in harmony with the ideas of the faculty as to how nature study should be taught in the grades, the author prepared written outlines for the work in the grades each month, and hectographed a sufficient number for the use of each critic teacher in the school.

Many teachers and school superintendents visit the State Normal School; and these, being pleased with the science work done, requested that copies of the outlines be mailed to them each month. These requests were granted cheerfully, until the number became so great that permission was obtained to have two or three hundred copies printed each month. Some of these printed outlines were sent with the University's exhibit to Los Angeles, when the National Educational Association met there in 1900, and were distributed free. Subsequently many requests for them were received from various parts of the United States. Our mailing list grew until it reached the number of nearly fourteen hundred! Almost every teacher in the state received a copy.

Finally, at a meeting of the Utah state text-book commis-

sion, held in 1908, to adopt text-books for the ensuing five years, the author was requested to compile the lessons and suggestions embodied in these outlines into a text-book,— a more convenient form for use in the schools. The present work is the result of the agreement reached on that occasion, and includes, besides the best that the monthly outlines contained, a number of lessons, suggestions, and illustrations prepared especially for these volumes.

The work is graded carefully, so that the various topics will not be repeated to the same children year after year, since each grade is provided with a full year's work, adapted as well as possible to the age of the pupils, and different from the work given in subsequent grades. This feature — one most difficult to determine in some cases — gives new work continually and adds much to the interest and value of the series.

For this selection of topics adapted to the different grades, the author is greatly indebted to the faculty of the Normal Training School. They have held many meetings, discussing the topics chosen and the arrangement given herein; and while mistakes, perhaps, have been made that may necessitate changes, the well-known ability of the teachers composing the faculty gives assurance that on the whole the selection and arrangement are good, having been demonstrated by them in actual teaching.

If this book shall prove a helpful, suggestive manual to teachers and students in their study and investigations of the phenomena of nature seen in common things about them, the aim of the author will have been achieved.

H. H. C.

Salt Lake City, Utah.

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GENERAL INTRODUCTION

I. The Motive of Nature Study

Happy is he who lives to understand,
Not human nature only, but explores
All natures, — to the end that he may find
The law that governs each; and where begins
The union, the partition where, that makes
Kind and degree, among all visible Beings;
The constitutions, powers, and faculties,
Which they inherit, — cannot step beyond, —
And cannot fall beneath; that do assign
To every class its station and its office,
Through all the mighty commonwealth of things
Up from the creeping plant to sovereign Man.
Such converse, if directed by a meek,
Sincere, and humble spirit, teaches love:
For knowledge is delight; and such delight
Breeds love: yet, suited as it rather is
To thought and to the climbing intellect,
It teaches less to love, than to adore;
If that be not indeed the highest love!

— Wordsworth.

Since the motive that underlies nature study will determine largely the method of teaching it, a brief discussion of the fundamental principles of this motive will make the lessons and suggestions contained in the following pages easier to adapt and more productive of good.

The wonderful amount of knowledge and power acquired in early childhood has no doubt astonished every student of psychology. Beginning life with only a few instincts and the capacity to receive impressions through his five senses, the child acquires in an incredibly short time a knowledge of language, science, and art, truly surprising. The study of the reasons for this rapid advancement has led to the most important changes made in recent years in methods of primary teaching.

A wonderful interest and ceaseless energy seem to impel the child to go from one thing to another, gaining and storing up experiences which in some way combine in later life into the most useful and necessary constituents of an education. Suddenly deprive the college student of these primary, fundamental experiences and their effects, and he would have little with which to interpret his later study; it would necessarily be meaningless.

If, as it is generally conceded, the child makes more rapid progress from three to six years of age than during any subsequent like period, and if we can discover and retain the motive which actuated him and use the methods he followed, then his progress will not be retarded upon entering school.

By a process of elimination let us seek this true motive. A moment's reflection will assure us that the child does not act through fear of punishment or blame; nor is he prompted by a desire to please others. He does not feel the pressure of a sense of duty; nor does he plan to secure praise or avoid blame. He is not sufficiently mature to realize that the knowledge he is acquiring will be useful to him in after life, or of benefit to others. None of these motives can possibly weigh much with young children and should be used with them only in exceptional cases. What natural characteristics,

then, do children manifest which may influence their acquisition of knowledge?

In the small child, as well as in the young of most animals, there seems to be something in which simple physical exercise — motor activity — excites the keenest pleasure. If this be true, should not the school work in the lower grades be more closely associated with muscular effort?

Again, the "natural curiosity" of the child — his proneness to see, to hear, to handle, to ask questions about things — is proverbial. Besides, then, the pleasure arising from motor activity, there is another, equally strong, — the joy one feels on acquiring knowledge or making a discovery. It is sometimes called "intellectual feeling."

These two motives are ever-present with the child and keep him in constant and changeful contact with his environment, with whose laws and characteristics he is thus becoming familiar. Think how easily is forgotten a promise of reward or a threat of punishment, when compared with these two great motives in the moment of temptation. What teacher could maintain the usual school work during the passing of a circus parade or a match ball game on the campus?

Activity, then, seems to be at once the law of growth and the source of pleasure, — activity of muscle and of mind. The child enjoys much better using his own sense of sight, touch, taste, etc., than hearing another describe the appearance, touch, or taste of an object. How much more interest a child takes in a live animal present than in any oral or written description of it!

The child also inherits the social instincts of the race and loves to do what he sees others doing. His desire to imitate is strong and is used to great advantage by the teacher who

is wise enough to base lessons upon social activities familiar to the child, and which, therefore, appeal to him.

These natural motives, being so much stronger than the artificial ones, should be appealed to most frequently, though a few words of praise are often of great value and are pleasant alike to the giver and the recipient. Seldom should blame or threat of punishment be resorted to in an effort to secure the attention and preparation required.

Psychology has revealed the wisdom of the Creator in planting thus deeply in the child an instinct to investigate things, and to get through his own experience a knowledge of his environment. These original percepts are of the highest value and are absolutely necessary to his development and welfare.

It is a law of the mind that new things presented to it are interpreted or understood by means of, and in proportion to, the strength and number of impressions already in the mind that are similar to those made upon it by the new thing presented. Thus, when we see a new animal, we classify it as a bird, a fish, or a reptile, according to the characteristics it has that correspond to our previous knowledge of birds, fishes, and reptiles.

The relative value of original percepts compared with impressions gained entirely through the experiences of others, is illustrated strikingly by a remark of a man who was born blind. After hearing a discussion about the color "scarlet" and a description of it, he exclaimed: "Oh I know what scarlet is: it is like the sound of a trumpet." He had no percept of color to interpret what he heard.

The teacher's motive, therefore, should always include an effort to get the child in contact, through one or more of his five senses, with the things being studied.

II. The Method of Nature Study

We have book-teachers enough. Oh, for more bookless ones!
—Bishop E. A. Thompson.

The school work should be based as much as possible upon the environment and activities to which the pupils have been accustomed. They will then better understand the new thoughts, which will react and make plainer the old ones, thus making the school life and home life act and react upon each other, and develop into an unbroken whole. Teachers should give abundant observations, but require only the simplest inferences from the smaller pupils. Let pupils suggest and perform experiments illustrating the laws of nature. Plan and give field lessons where things being studied may be seen under natural conditions. Visit places of industry and sources of supply of useful things.

Thoughts and principles acquired in this way may be strengthened by letting the children express them orally, or in writing, drawing, painting, making, etc. Base the lessons upon the actual work or observations of the pupils, and when a principle is understood, function it by discovering where it is used in nature or by man.

For example, when the principle of capillary attraction is developed by a common laboratory experiment — such as inserting a small glass tube into water and noting that water rises therein and that the finer the tube the higher the water rises, — many illustrations of this law should be given, such as the absorbing power of the sponge, lamp wick, towel, blotting paper, etc. Afterwards, in discussing other topics where capillarity is involved, refer back to the principle again in showing, for example, how the sap in plants circulates, or the blood in the capillaries of animals, etc. Even in the

subject of irrigation this principle plays an important part. The educated farmer, after irrigating, runs a cultivator or other implement down the furrow to cover the mouths of the capillaries which conveyed the water downward; knowing that if he does not, these very capillaries will draw the water back out of the ground, to be evaporated by the warm sun and wind, thus robbing the plant roots of much of their needed moisture. By constantly applying principles once learned, the pupil gets into the habit of looking for every possible influence that may be involved in any set of circumstances or conditions, and so acquires ability to discover, and to give to each element its proportion of influence in the total results, — a most essential thing in all affairs of life.

In the grammar grades continuous *observations*, properly recorded and subsequently compared, must often precede the discovery of a law or principle. The power and strength developed in this long process is of greater educative value than the simple possession of the fact, which, possibly, the teacher could have imparted in a few moments. Making and recording observations and writing descriptions of experiments performed and of deductions made from them, are processes of the greatest value, adding interest to the work and establishing true and scientific habits of work and thought.

Some of the work, especially that in biology, is so much influenced by the weather conditions and the seasons, that it naturally divides itself into fall work, winter work, and spring work, in order to take advantage of the abundance of illustrative materials at hand, and of the prevailing trend of the child's mind outside of school hours.

For example, spring is much better than fall for the study of germination and inflorescence, while the latter season is

preferable for the study of fruits and seeds. This thought influences in a degree the arrangement of the lessons given.

Except for pure literary effect, inanimate nature should not be personified, nor human attributes and sensibilities given to inhuman things for the purpose of securing the child's interest. Nature, properly taught, is new and fresh and pleasing to the child, and needs no such embellishments as fairies, gnomes, ghosts, or elves to make it attractive. This evil, which has been committed by so many teachers and authors, is an unpardonable mistake, in that it destroys the proper attitude of the child to the subject, creates fear and superstition, and spends time in erecting a structure that later it must take time to destroy.

The mischievousness of this sort of nature teaching may be illustrated by a personal experience. While trimming a young orchard at his home, the author was once accompanied by his six-year-old daughter. With evident uneasiness she watched the clipping off of the small branches for a time and finally asked, "Papa, why do you cut off those limbs?"

"So the tree will have a proper shape and grow to give us fine fruit," was the answer.

"Well, you ought not to do that, for it hurts the tree. How would you like your arm cut off?"

Suspecting the source of this error, the father asked, "Who told you that it hurts a tree to cut off one of its branches?"

"My teacher said so," she replied confidently.

"I think you must have misunderstood your teacher. It hurts the tree no more than it hurts you to have your hair or nails trimmed."

Two years later the father was trimming the same orchard, and again the little girl was with him.

Recalling the former incident, and to test the effect of the child's wrong teaching and his effort to set it right, he asked:—

"Norma, do you think it hurts the trees to cut off these limbs?"

"Yes, papa," she replied promptly.

"Who told you so?" asked the father.

"I don't know, but it hurts them," she emphasized with unshakable credulity.

"Did your teacher tell you so?"

"No," she answered.

It was evident that the source of this error had been forgotten, but the *effect* remained undimmed by the lapse of time or by the father's original effort to explain it away. Who can say how long this error will cling to that child, and unnecessarily disturb her sensibilities? This pernicious result no doubt came from a constant use of personification and allegory, without leading the child to differentiate in thought or feeling between the figures and the reality.

In these lessons, most of the topics in any given grade admit of being developed beyond the capacity of the pupils in that grade. While it is pedagogical to go from the known toward the unknown, this process should not be unduly hastened; otherwise, confusion and discouragement result. Do not ask questions of pupils who have not data to give proper answers. Pernicious guesswork is the common result. Every lesson should be based upon an experiment or upon some previous observation, experience, or knowledge, and should be developed therefrom in a logical way as far as the majority of the class can follow.

III. The Scope of Nature Study

He who knows what sweets and virtues are in the ground, the waters, the plants, the heavens, and how to come at these enchantments is the rich and royal man. — Emerson.

A great many of the books published on nature study confine themselves to the consideration of animal life and plant life. This is surely a mistake, especially for children reared in large cities. While it is admitted that living things are more attractive to children than dead things, the average child knows too little of animals and plants from contact with them to be greatly benefited by studying them,— especially such phases of biology as are so frequently chosen for lessons in text-books. The average city child's mind is impressed with a score of percepts derived from physics, perhaps, to one derived from botany or zoölogy. The wonders of light, heat, sound, electricity, gravity, friction, etc., are impinging his consciousness incessantly. Then, if nature study should treat of the child's environment, why should he not study these things? Is he not as interested in a kodak or a telephone as in a crawfish or a toadstool?

Nearly one third of the nature study work, especially in the grammar grades, should be based upon physics. Geology, mineralogy, chemistry, astronomy and meteorology, agriculture and the industrial activities all contribute to enrich the course, but none of them should be taught in a cold, isolated way. A child loves to see a relation almost as well as an object. He should learn things in their natural relations in order to see their beauty and use.

Physiology and Hygiene. — That the results of using the many text-books prepared on this subject for the common schools are much below the expectations of both authors

and teachers, is conceded generally. This disappointment is due no doubt more to the fault in the method of the treatment, than to the fitness of the subject to the needs and interest of the child. In isolation physiology has few attractions for the average pupil, but when included in a course of nature study, and taught in its natural relations, it shares necessarily the interest always so abundant in that work and is understood in its true significance and appreciated accordingly.

When studying the organs of lower animals and their wonderful adaptations to the needs of their respective owners, what could form a more fitting climax than to call attention to the similar and more perfect organs of the human body, and to explain their uses and care! Again, in studying a rain storm or snowstorm with the accompanying phenomena, attention may be directed to the necessity of keeping the feet dry, and the body properly protected. In our study of human dwellings, the furnishings and uses of the bathroom would offer a fitting occasion to teach the pupils the necessity of personal cleanliness, and of the care of the skin.

A few suggestive lessons are, therefore, included in the following outlines on the subject of human physiology and hygiene, and are suited as well as may be to the needs of the pupils in the various grades, with the hope that the teacher will do as much more of this work in an incidental way, as the turn of the discussion in any lesson may afford suitable opportunity.

With very young pupils this work should be incidental rather than regular, and practical rather than theoretical. Since little children cannot comprehend the structure of the body or the laws of health and the necessity of obeying them, the teacher can do no better, perhaps, than establish health-

promoting habits, and guard the pupils from the many dangers to health that abound in school life.

Since in other things "we learn to do by doing," so the child will best learn the laws of life by living in a healthful way; and the teacher, while furnishing the best possible conditions for mental development, should be no less concerned with securing the best possible conditions for the physical growth of the child.

Excursions and Field Lessons. — As teachers come to realize the value and importance of original percepts, they provide more opportunities for securing them for their pupils. Occasional well-planned excursions, field lessons, or visits to places of industry will prove helpful to the whole school. The particular places to be visited will be determined by the topics being studied and the places convenient to the schoolhouse. No neighborhood in which a school can be maintained will be without places of interest to visit, where operations of nature and occupations of man may be studied.

Following is a list of a few such places in or near most cities: —

Garden	Brickkiln	Museum
Orchard	Stone Quarry	Post Office
Farm	Iron Foundry	Railroad Station
Nursery	Blacksmith's Shop	Power House
Canal	Candy Factory	City Waterworks
River	Shoe Factory	Reservoir
Lake	Woolen Mill	Fire Department
Parks	Book Bindery	Police Station
Cañon	Machine Shop	Public Library
Hills	Fish Market	Printing Office
Cave	Meat Market	Telegraph Office
Swamp	Bakery	Telephone Office
Mountains	Grocery Store	Weather Bureau
Limekiln	Department Store	Unfinished House

Materials, Apparatus, Pictures, etc. — Field lessons and excursions consume much time, however, and do not afford a means of illustrating all the principles of science which interest children. A few pieces of apparatus and some simple materials kept in the schoolroom will aid the teacher much in nature work. The following articles are inexpensive and will be found very useful: —

Thermometer	Florence Flask	Prism
Barometer	Kerosene Lamp	Magnet
Several Lenses	Alcohol Lamp	Beakers
Hand Microscope	Glass Tubing	Bottles
Corks, various sizes	Rubber Tubing	Pinchers

Also, half a dozen ½ in. test tubes; a simple magnetic compass; spring balance, or other means of weighing; some of the simple reagents; one ounce each of muriatic, nitric, and sulphuric acid, and of ammonia; and one pint of alcohol.

The teacher's ingenuity often will be called upon to construct suitable pieces of apparatus as needed. A few of the latter are suggested in the text.

If requested, the pupils will bring many useful things from their homes, while field lessons and excursions will soon produce a valuable and useful cabinet of specimens. Insect specimens are easily obtained and preserved: some of the smaller forms of animal life may be kept in alcohol, while a limited number of birds and larger animals properly mounted may be procured for a few dollars. These are all very useful for comparison and illustration throughout the course and should be found in the school cabinet.

The study of *things* should precede and lead up to the study of *books;* the connecting link between them is good pictures. In giving the child correct images of the various

objects studied, good pictures are inferior only to actual observation. They should never be used instead of the object, however, when the latter can possibly be obtained.

Pictures are now so abundant and accurate that they at once extend the boundaries of nature study in all directions almost without limit. Newspapers, magazines, railroad folders, catalogues, calendars, and many other forms

A School Cabinet

of advertising matter are teeming with the best of pictures and may be had for the asking. Interest the students in collecting pictures and in a short time an abundant and ever-increasing supply will be on hand. These should be carefully grouped, mounted, and labeled, and placed where any desired group or series may be found instantly. A series mounted on a large cardboard will form a useful

chart: or they may be placed in a large paper envelope made by the children for that purpose and properly labeled.

In response to this demand for pictures in schools, publishers have prepared and offer for sale excellent groups of nature study pictures, black and in colors, at reasonable prices. These are very valuable if properly studied.[1]

In a similar way, fitting articles on nature topics may be cut by the pupils from current magazines, bound in heavy paper, properly labeled, and used as books in a library. Many of these articles are written by specialists and experts and deal with the latest developments of science and progress.

To the class studying a given industry, an address by a workman actively employed in that line will be of great value. A practical talk by a miner or sailor, even though ungrammatical, will give clearer ideas to a class studying mining or navigation than the smoother sentences of the regular teacher whose knowledge of the subject is only theoretical.

A Text-book and its Uses. — In most other subjects of study a text-book may be followed to lessen the labor of the teacher and without detriment to the pupils; but, as already explained, the very life of nature study is the study of *things*, not *books*. For this reason most of the text-books on this subject are hurtful to the pupil, and themselves hinder the purpose of their authors. They are only screens placed between the child and nature and obscure the view. Inasmuch as children are studying *books*, *books*, *books*, during their entire school life in all other branches, the author pleads that they may be allowed to study *things* in this branch.

If this view be a wise one, then it follows that the environment of each school must contain most of the things studied.

[1] A. W. Mumford, Chicago, has made a specialty of nature study pictures, mostly in colors.

No nature study text-book can be made so comprehensive as to be a complete guide for every school, and to provide in detail materials for each lesson as text-books on other subjects do. The teacher must be depended upon, then, to fill in the detail for each day's lesson, since a text-book can work out only a general plan based upon features common to the environment of most schools. It can do little more than suggest possible topics for study in various localities and seasons, and illustrate how these subjects may be developed in the different grades. The teacher must build upon these suggestions, and modify or substitute as conditions may require.

In the grammar grades the teacher may receive more direct aid from the text-book; for the pupil can be directed by it as to what should be examined, methods of procedure, inferences to be drawn, and applications to be made. The great benefit sought is not primarily the securing of a required number of facts by the pupil, but that he may be led to love, appreciate, and utilize wisely the environment placed around him by a benevolent Creator.

FIRST GRADE

SUGGESTIONS TO THE TEACHER

Basis of First Grade Work. — The content of the mind of the little child who first enters this grade is derived from his home environment. His fund of knowledge and experience contains little save what the home has furnished and the teacher must build upon this foundation. For this reason the subjects considered in this grade include such common things as the house and its parts, clothing, food, domestic animals, common insects and plants, the weather, the sun and moon, pebbles, a school garden, etc., — a variety of things familiar to most children.

In developing these lessons, the teacher should use words and illustrations commonly heard in the home, and seek to develop ideas and experience already acquired, rather than to build a new mental structure, foundation and all. The home life will then be made to enrich the school life and none of the child's valuable experience be wasted.

There is a great need of bringing the school life and experience nearer to the real life and this grade is a good place to begin. In fact, it is the firm belief of the author that all school work, and particularly the part done in the grades, should be influenced and unified by the natural conditions, needs, and unfolding of the child in his home and social environment. The school work should be so

modified as to take hold of these conditions, unfold them to the child, and put fuller, richer meaning into them.

Social Activities. — Among the many things which children may do in connection with their work in nature study during the year, the following activities are suggested: —

Study an ant bed.

Collect cocoons, wasp nests, insect specimens, etc.

Make cardboard houses and shelters of animals studied.

USEFUL THINGS MADE BY FIRST GRADE PUPILS

Bring the eggs of a frog or toad to school; they may be hatched if kept in a vessel of water.

Get a hen to set and hatch where the pupils can watch and care for her.

Visit many places of activity, stores, factories, etc.

Take frequent field lessons.

Make a school garden and keep it in good condition.

Draw, or model in clay, things studied.

Dramatize animals and other things studied.

Have a play house; a play store.

Make an aquarium, if it be only a half-gallon glass jar, and stock it with animal life.

Make window boxes, or get flower pots for plants and have flowers in the schoolroom windows.

Clean and keep orderly the school grounds.

Make useful things in the sloyd or manual training room, if there be one.

Dry fruits in their proper season.

Dig a potato pit and store some potatoes for winter.

Cut and paste pictures on charts to illustrate lessons.

Hem dust cloths and do other simple sewing.

Do special decorative work, etc., for holidays.

Visit the State Fair and study the various exhibits. Base lessons on what interests the children there.

Make bows and arrows and teach their uses.

Pupils may aid in many experiments to illustrate principles taught in nature study.

Make varied observations of natural phenomena. Collect specimens.

The teacher, familiar with the environment of the children, will think of many more activities, and may omit such of the above as prove to be impracticable for her school.

Correlation. — The foregoing activities, and much of the work mentioned in the lesson outlines, may be made to furnish material as well for lessons in geography, language, art, and reading as for lessons in nature study. In fact, the work in the lower grades should be so unified that the recitations in all these branches need not be differentiated in the minds of the pupils. They correlate closely and naturally, and form simply different parts of a daily educative experience under the guidance of the teacher.

CORRELATION WITH ART — BLOCK PRINTING

A design taken from nature study work and used in decorative work in the domestic art department of the University of Utah Training School.

ORIGINAL DESIGN FOR BORDER

CORRELATION WITH MANUAL TRAINING

Spirit of the School. — School work in the primary grades, and particularly in the first year, should not be very formal. A proper familiarity among pupils, and between them and the teacher, should be established, similar to the feeling in a well-ordered home, that the greatest freedom for school work may be given. No unnecessary restraint should impede the flow of school activity, or prevent the best thought work or hand work of which the pupils are capable.

In the lesson outlines which follow, the question method predominates, and savors, perhaps, of formality. But this method of presenting the thoughts is used only for the sake of brevity, and to impress the teacher with the necessity of appealing constantly to the child's experiences and observations. This appeal is the best, if not the only, way to organize, stimulate, extend, and give meaning to the child's experiences and observations, *i.e.* to educate him.

If the same thoughts can be brought out in the form of a story, instead of by questions, and in such a way as to involve the aid and experience of the child, the story form will be better than the question method, since stories appeal so strongly to the young. A combination of both methods, however, may be as good for the child and easier for the teacher.

Sample Lessons. — To illustrate how the following outlines may be used as a basis of a lesson story, two samples of such lessons are given here in full.

I. The Cat

(See Lesson XXII, First Grade.)

Points to be brought out. — Its use; its teeth, claws, eyes, foot pads, "whiskers," and their adaptation to the needs of the cat; its covering; its voice; its methods of defense;

the nature, number, and care of its young; its disposition, habits, etc.

Teacher. — My younger brother, James, who attends school here in the sixth grade, has a fine, large, black cat at home. It is covered all over with — what?

Pupil. — A thick, soft fur.

Teacher. — What is this thick fur for?

Pupil. — To keep the cat warm in cold weather.

Teacher. — Have you ever noticed if a cat's fur is thicker at one time of the year than at another?

Pupil. — Yes: it is thicker in winter than in summer.

Teacher. — Yes, in the spring time if we stroke the cat on the back, many hairs will come out and get on our clothing. We say pussy is *shedding* her coat. James thinks a great deal of his cat and feeds her with — what?

Pupil. — Meat.

Teacher. — Yes; the cat never eats hay or grass, as the cow does, nor grain, as the chickens do. She prefers meat. James keeps his cat for a pet and calls her Tabby, but mother is very glad to have a cat about the house for another reason. Can any one tell me for what reason?

Pupil. — To catch mice.

Teacher. — What harm do mice do?

Pupil. — They eat bread, cheese, pie, cake, or whatever food they can find.

Teacher. — They sometimes gnaw books and papers; and they once ate a great hole in my silk dress that was put away in the closet. I suppose they were getting soft materials with which to line their nests.

One evening when we had been cleaning house and things were all out of order, I was at work in the bedroom when I heard a rustling in the closet. Tabby was near me and

she heard the sound, too, and at once crouched low down, close to the floor, and started toward the closet. What do you think caused the sound?

Pupil. — A mouse!

Teacher. — She glided over the bare floor, for the carpets were all taken up, without making the slightest noise, for she had —

Pupil. — Soft cushions on the bottoms of all her feet.

Teacher. — To reach the closet, the door of which was partly open, she first tried to pass between a chair that stood by it and a dustpan that leaned against it. She put her nose between the dustpan and the chair, but drew back. Why did she not go through?

Pupil. — Her "whiskers" or "feelers," which are just as wide as her body, could not go through so narrow a space.

Teacher. — That's right; she feared, if she attempted to crowd her body through, that she would knock down the dustpan — and what harm would that do?

Pupil. — It would scare away the mouse.

Teacher. — So Miss Tabby backed out and crept around the chair and entered the open closet door. Now, it was so dark in the closet that I could not see what the cat did in there, but she did not seem to mind the darkness at all. Why?

Pupil. — Cats can see in the dark.

Teacher. — That is true. Why do cats need to see in the dark?

Pupil. — The mice come out more at night than in the daytime. We scare them away in the daytime, but we are asleep at night.

Teacher. — Yes, night seems to be a good time for the cat to catch its prey. For a little while I heard nothing from

the closet. I was about to step in myself and see what had become of the mouse, when I heard the cat spring. A brief rustle followed and I heard a peculiar squeak, which I recognized as the cry of the mouse. I knew then that the mouse was caught. I sprang forward and saw it held firmly in the claws of the cat. The mouse struggled hard to get away, but kitty's claws seemed much longer than I had ever noticed before and she held the mouse very firmly. Tabby did not keep her prisoner suffering very long, however, for she opened her mouth very wide and took the mouse between her teeth — what kind of teeth has a cat?

Pupil. — Sharp, pointed teeth.

Teacher. — And she gave the poor mouse such a squeeze that its struggles soon ceased. She did not eat her well-earned supper, but started downstairs calling loudly to her kittens. What kind of noise does a cat make calling for her kittens?

Pupil. — Mew! Mew! Mew!

Teacher. — I followed her downstairs to see what she would do with it. When she reached the kitchen, she met a great danger. Some one had let in old Shep, our dog, and he came toward the cat, wondering what she had.

How do cats look and what do they do when they are very much frightened, but want to defend their young?

Pupil. — They ruffle up the hair on their backs and tails and make a loud, hissing noise. They will often scratch and bite, too.

(Let pupils imitate the noise of the cat.)

Teacher. — Well, one scratch on Shep's nose with pussy's long, sharp claws was enough to make him run away, and Tabby went to where her five kittens were in an old basket. She laid the mouse down in the midst of them and mewed

quite loud. They were not big enough, however, to eat the mouse. What do little kittens live on?

Pupil. — Kittens suck milk from their mother.

Teacher. — Kittens when first born are too little and weak to tear and eat raw meat, so they nurse their mother. They cannot walk around or even see till they are nearly two weeks old. But the mother takes good care of them, and when they get big enough she teaches them to catch and eat mice and other small animals. What other animals have any of you seen a cat catch?

Pupil. — One time I saw our cat with a poor little bird in its mouth.

Teacher. — Yes, the cat kills a great many pretty and useful birds, especially when she lives out in the country where the birds build their nests in the trees. Cats often climb trees and rob birds' nests of their young and even catch the mother bird who tries to defend her little ones.

Pupil. — Can't the cat be taught not to catch birds?

Teacher. — That is very hard to do, as it is their nature to catch birds as well as mice. Even when cats have been well fed, they seem to like to catch prey just as well as if they were hungry.

II. The Seasons — Autumn or Fall

(See Lesson XVII, Second Grade.)

Points to be brought out. — Name; shorter days; colder weather; fall work indoors and out; changes in plant life; disappearance of birds and insects; position of the sun; games and sports; preparation for winter.

Teacher. — Albert Brown lived in a large city. He had spent the days of his summer vacation at home alone, for

his father had taken his mother to a resort in the mountains, as her health was very delicate. Why did she go up into the mountains?

Pupil. — Summer weather is so hot in the city that it makes many people ill. She went into the mountains where it is cool in summer.

Teacher. — When the days became cooler in the city, she returned, and promised Albert that as soon as they got the fall work done and everything fixed for the coming winter, he might go to visit his cousin, Ray Wheeler, who lived in the country. Albert was delighted with this promise and pitched into the work right manfully in order to get it done as soon as possible. What work did he have to do?

FIRST GRADE CALENDAR

The card for each month is prepared by the teacher; the pupils fill in the dates. Often the conditions of the weather, clouds, wind, phases of the moon, etc., are indicated at the same time that the date is entered. (See Calendar, p. 56.)

Pupil. — Rake the fallen leaves from the lawn and burn them.

Teacher. — What else?

Pupil. — He cleaned out the furnace and prepared a quantity of kindlings to be used, if needed, while he was away.

Teacher. — Can you think of anything else he needed to do?

Pupil. — Close the cellar windows so the frost could not get in to freeze the fruit and vegetables placed there for winter use.

Teacher. — Anything else?

Pupil. — He took down the window and door screens.

Teacher. — He also helped to cover the tender plants in the flower garden, and made his dog a warm kennel. When the work was all done, his mother told him to get ready to go on his visit. What do you think he would need to do for himself?

Pupil. — Put on heavy underwear and take an overcoat.

Teacher. — What kind of weather do we often have in the fall?

Pupil. — Rainy weather; but why do we call it *fall?*

Teacher. — What happens to the leaves and seeds and fruits of most plants at this season of the year?

Pupil. — They fall.

Teacher. — I presume this is why they call this season the fall. At last Albert got ready to start. What playthings do you think he took with him?

Pupil. — A football, his top and string, and perhaps some marbles.

Teacher. — With a light heart he got on to the train, and after riding an hour and a half he arrived at a country station. Here he was met by his cousin, who had brought a horse and buggy to take him to the farm. The two boys were delighted to see each other, and drove leisurely along the road toward Ray's home. Here, too, the trees were beginning to shed their leaves. Did he see as many birds and butterflies as he did when he was there in the spring?

Pupil. — No; the butterflies all go away, as do most of the birds in the fall.

Teacher. — Why do they go away?

Pupil. — It is too cold for them.

Teacher. — Is there any other reason?

Pupil. — Perhaps they can't find enough to eat.

Teacher. — "Your horse looks very rough," said Albert. "He was sleek and glossy when I was here before. What makes him so shaggy now?"

What do you think was Ray's explanation?

Pupil. — The horse was getting his long, thick coat of hair to keep him warm during the winter.

Teacher. — The boys enjoyed the ride very much, but to their surprise it was nearly dark when they arrived at Mr. Wheeler's farm. Why did it seem to get dark so soon?

Pupil. — The boys enjoyed the ride so much.

Teacher. — Was there any other reason?

Pupil. — Days grow shorter in the fall.

Teacher. — What makes them grow shorter?

Pupil. — I don't know.

Teacher. — Where does the sun rise and set now? Describe its path through the sky now. (Pupil does so.) Show me what its path was in the summer. (Pupil points or traces with his finger.) Which path is the longer?

Pupil. — The path it makes in the summer.

Teacher. — As it is day when it is passing over its path, when, then, will we have the longest days?

Pupil. — In the summer time.

Teacher. — Well, the boys unharnessed the horse, put him in the stable, fed and blanketed him, and went into the house where Mrs. Wheeler had a warm supper ready for them. I will tell you next time what they saw and did on the farm.

FIRST GRADE — FALL WORK

LESSON I

POINTS OF THE COMPASS

WHERE does the sun rise? Where does it set? Point to the place where it rises; where it sets. The sun rises in the east and sets in the west. Mention other things that are east of us; west of us. When we face the east, or rising sun, our left hand is toward the north and our right hand is toward the south. How is it when we face the setting sun? Point to the east; the south; the west; the north. Have the pupils name objects that are in various directions from them until the notion of direction is fixed in their minds.

Show them a compass and teach them its use in giving a knowledge of direction. If the streets are regular and are named according to their direction from a given point, as is the case in many cities, teach the pupils the naming and numbering of the streets and houses as far as they may be able to use and understand such information.

LESSON II

THE WEATHER — RAIN

What kind of weather have we to-day? Do you like this kind of weather? Why? Is any one injured by it? Who enjoy this kind? Why?

Is it always this kind of weather? When was it different? When do you think it will change? Does rain do any good? Who are most benefited by it? What would happen if it did not rain for a whole year? Did you ever hear of a country where it seldom rains? Describe it. Should you like to live there?

Discuss the effects of rain upon plants, animals, and man, as far as the time and intelligence of the class will permit. Show pictures of desert conditions and dense tropical vegetation, to impress the value of rain to vegetation.

Ask the pupils if they can tell when it is going to rain. How? What kind of clouds cover the sky when it rains? What kind of clouds may be seen on a clear day? Describe rain clouds; fair-weather clouds. When the wind blows up in the sky, it spreads the clouds out in long streaks; these we call wind clouds. Tell me each morning which kind you see in the sky, and what kind of weather we shall have during the day.

NOTE. — Should it not be raining when it is desired to give this lesson, the teacher may tell a story in which the principal conditions of a rain storm are brought out, — the pupils assisting, especially in the descriptive parts, thus recalling what they have observed about rains.

LESSON III

THE WEATHER — SNOW

When it storms, does it always rain? When does it snow? What sports do we enjoy when there is snow on the ground?

Discuss coasting, sleighing, snowballing, etc. Tell stories connected with these activities, illustrating some of the properties and uses of snow, and conditions which accompany a snowstorm.

Where does most snow fall, upon the mountains or in the valleys? When much snow falls upon a steep roof, what sometimes happens? When much falls upon a steep mountain side, what sometimes happens there? Discuss snowslides and avalanches, and tell simple stories connected with them. What becomes of the snow? When does it melt? What does it form when it melts? Discuss the uses of our mountain streams for drinking, irrigation, etc.

NOTE. — A fuller discussion may be given in winter after a snowstorm.

LESSON IV

THE WEATHER — TEMPERATURE

Why does it not snow in summer? What is the chief difference between summer and winter? If snow should begin to fall on a hot summer's day, what would happen to the snowflakes before reaching the ground? Why?

Where does the earth's heat come from? Which is warmer, day or night? What parts of the day are coldest? What part of the day is hottest? Where is the sun at noon? in the morning?

What effect has the wind upon temperature? What winds are coldest? Do clouds make it warm or cold?

Do plants grow better in warm or cold weather? Which do animals like better? What do we do to keep ourselves warm in winter? Is it warmer or colder when it storms? Can you tell when it is going to rain? How?

Have the pupils foretell a coming storm, and describe the leading features. Show them pictures of summer scenes and winter scenes.

LESSON V

THE WEATHER—WIND

Where do the rain and wind come from? Where do the clouds come from? What brings them from the ocean so far away? Have you seen the wind move other things? Did it ever blow your hat off, or blow dust in your eyes? What do you call a very gentle wind? a very hard wind?

Discuss the uses of wind such as would appeal to the child. Show him a windmill. Let him make one; also a fan, a kite, etc. Have him draw these objects.

Do winds ever do any damage? What damage have you seen them do? Tell pupils of the cyclones of Kansas, the hurricanes of the Antilles, etc., the destruction caused by the great waves made by the wind. Let pupils make toy ships to illustrate the use of wind in navigation.

How do we name the winds as to their direction? If they blow from the south, we call them south winds. Winds are called from the direction from which they come. How do we call them to indicate their force or speed? Explain a zephyr; a breeze; a wind; a gale; a hurricane; a cyclone; etc.; and discuss the work of each.

Make a weather vane and let the pupils observe and report the direction of the wind for a few weeks. Record the results upon the blackboard each day.

LESSON VI

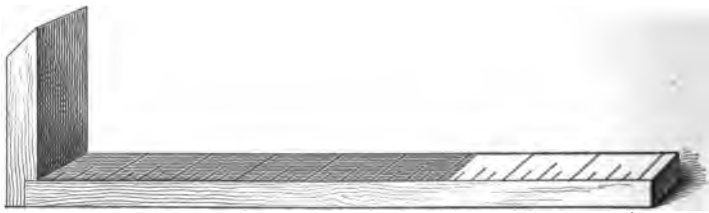
THE SUN—DAY AND NIGHT

When is it warmer, in the daytime or at night? Why? What gives the earth its light and heat? Where is the sun

at night? Point to where the sun rises; to where it sets. The first direction we call what? The latter we call what? Which is north? and which is south? Recall work already done, and impress these directions upon the minds of the pupils as may be needed.

Notice each day for a week or two if the sun rises in exactly the same place. Likewise notice the place of sunset. Instruct the pupils to make their observations from the same window or point of view each time, and notice what mountain peak or natural object is near the place where the sun rises or sets. In a week or two they should be able to discover that the sun is moving south.

By using a shadow-stick, the pupils may find if the sun's position at noon is changing. How? Trace through the sky with the finger the daily path of the sun.



A SHADOW-STICK

A shadow-stick may be made by fastening to a horizontal strip of lumber fifteen inches long, an upright four inches high at right angles with it. Graduate the horizontal outward from the angle, indicating inches, halves, and quarters. In using the shadow-stick, place it in a horizontal position with the upright to the south at noon. The length of the shadow is seen at a glance.

The sunbeams, entering a south window, may be used for the same purpose. Each Monday noon, just before school is dismissed, call attention to the length of the sunbeam which falls upon the floor from the south window. Drive into the floor a brass-headed tack, marking its length.

These tacks will show the successive weekly changes in the length of the beam, and consequently the change in the position of the sun at noon.

In appealing to their experiences, get the pupils to see that the days are growing shorter. When are the days the shortest? When do we have the longest days? Compare the length of the sun's path from sunrise to sunset in winter and in summer, and show the connection between this and the day's length.

LESSON VII

THE SUN — TEMPERATURE

What part of the day is coolest? Where is the sun then? What part of the day is warmest? Where is the sun then? Why is it warmest near noon?

How do you hold your hands to the stove when they are very cold and you wish to warm them? How does the heat strike them in this position? How do we hold a handkerchief or other similar article in drying it by the fire? Use other illustrations until the relative effects of direct and indirect rays are understood.

A few examples from nature may aid in making this thought clear. Which side of a house is warmest in winter? Why? Which is warmer, a garden sloping downward to the south or to the north? Is the north or the south side of a mountain the warmer? Why is moss thicker on the north side of a tree in the forest?

Where is the sun in the winter time? How do its rays strike the earth in winter? Where is it in the summer? How do its rays strike the earth in the summer time? Explain, then, why it is warm in summer and cold in winter.

LESSON VIII

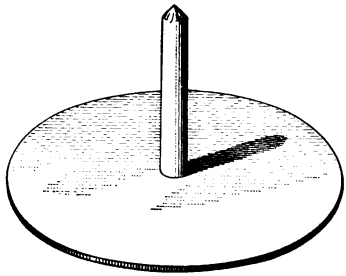
THE SUN — MARKING TIME

Most children old enough to attend school have felt the need of telling the time, and will, therefore, be interested in this lesson.

Pupils who cannot tell the time by the clock or a watch should be taught it at the first convenient opportunity. In many schools teachers are provided with a dial plate having two movable hands to be used expressly for this work. When not, teachers may make substitutes of cardboard, having wire or tin hands; these will answer better than drawings on the blackboard.

Where is the sun in the morning? at noon? at night? Can you tell from your shadow when it is noon? when it is evening? when it is morning? Where will your shadow be just halfway between morning and noon? between noon and night?

In olden times, the only clocks were sundials with marks to tell the hour by the shadow of an upright stick. Describe fully. Make a sundial.



A Simple Sundial

The day is divided into twelve hours and the night into twelve hours. Teach the pupils the numerals on the face of the clock. Each hour is divided into sixty minutes, — five between each two figures. As the hands go round and round, the small hand points to the hour, and the

long hand to the minute past the hour. The teacher may illustrate this with the apparatus already described.

Why do we need to know the exact time? Develop as many needs as the pupils can think of, and give them ample practice in telling the time as indicated by the teacher with the aid of the dial and hands. Relate stories illustrating the need of being punctual and hence of having a correct timepiece.

LESSON IX

HEAT RELATIONS TO PLANTS

In what season do plants make little or no growth? Why? When do they begin to grow? Why? When do they cease to grow? Why? What influence does the sun have, then, upon plant growth?

Recall the awakening of plant life in the spring. Note the growth of twigs and stems since then. Discuss the history of the season's growth, with a view to arousing the observation of the class as to what plants do as the weather becomes colder.

What plants are first injured by the frost? What trees shed their leaves when it gets cold? Mention plants that die as soon as cold weather comes. Do any continue to grow during the winter?

Compare the vegetation and the temperature of high mountains, which the pupils may have seen and experienced, with those of the valley where they may be living. Some pictures and stories of plant growth in hot and cold countries will now be interesting and full of meaning. Visit a hothouse, or study some window plants, with a view to impressing the pupils with the effects and value of heat.

LESSON X

A VISIT TO A FARM

If there is a well-cultivated farm within convenient reach of the school, arrange for an excursion to it. Notice how the crops are harvested and taken care of during the winter. Visit the granary, corncrib, fruit cellar, milk cellar, potato

FARM LIFE

Pictures collected by the pupils, and mounted by the teacher.

pit, haystack, barns, stables, henhouse, pigpens, etc., and study the activities connected with fall work on the farm. The cutting, binding, stacking, threshing, and storing of wheat are most interesting subjects for the little ones, if suitable object lessons accompany the instructions.

Later, a visit to a bakery and, if possible, the making of some cakes or biscuits in school will form a good lesson to show how the wheat raised on the farm is made into bread.

Collect pictures of farm implements, of scenes on the farm, etc., and make charts to illustrate the activities of farm life.

LESSON XI

MILK

What animal gives us milk? How does the little calf get milk from its mother? How do we get the milk? Describe milking the cows, or let pupils do so if they have visited a farm. For what do we use milk? What forms on the top of milk after it stands awhile?

Fill a test tube or bottle with new milk, and allow it to stand till the next day. Or, better, secure a pan of milk and allow the cream to rise. Skim it off, and then, by stirring or agitating it in any convenient way, make butter from it. Describe butter making, and, if possible, visit a dairy or cheese factory, and let the children witness the process of making butter and cheese from milk.

With suitable pictures, old and new ways of doing this work may be explained to the class. The Jersey cows are noted for the good milk they give.

LESSON XII

POULTRY

The eggs that we eat and use in cooking are laid by chickens. How many of you have chickens at home? Mention several good breeds, and describe them. Mention some ways in which eggs are useful.

Each hen will lay an egg a day when the weather gets warm in the springtime. When the nest gets full of eggs, if they are not taken away, she will begin to sit on them to keep them warm. She will remain on them night and day, leaving the nest only to get food and drink. In three weeks what do you think will happen? Each white egg will open, and a downy chicken will peep out and begin to chirp.

The old mother will then be kept very busy hunting food and caring for her large family. What food does she find for them? Describe the care of a hen for her chicks. How may we help her care for so many? How does she shelter them when they get cold? What shelter should we give the old hen? With good care the little ones soon become large and lay eggs, too. The Plymouth Rock chickens are good egg layers, and very pretty.

Make paper henhouses. Tell the story of "The Quarrelsome Cock," "The Ugly Duckling," etc.

LESSON XIII

THE CARE OF OUR BODIES

How does the old hen keep her little chicks warm? What happens to them if they get too cold or wet? How does the old hen keep warm? As the chicks grow larger, how do their feathers change? What do chickens need in the winter besides warm feathers? Would they thrive and be healthy if we gave them no shelter in cold weather?

How do we keep warm? When do we need the warmest clothing? What shelter do we have? How do we make our homes and schoolrooms warm in winter? Why? What harm comes to us if we get too cold? Why should we not

get our feet wet? What causes so many children to have colds or coughs in the winter time? To prevent, or cure these ailments, it is necessary to keep the body warm.

Discuss the proper use of umbrellas, wraps, and overshoes, and as far as possible see that the pupils observe the conditions decided to be necessary to health. The schoolroom temperature should be kept about 70° F. In securing the proper ventilation, care should be taken that none of the pupils sit in a draft of cold air. Aid the children in acquiring habits that promote health rather than teaching them the theories of hygiene.

LESSON XIV

FISH

Name all the kinds of fish you know. Which do you like best? Where do fishes live? How do they move? What do they eat? Did you ever catch one alive? How slippery they are! That is so they will glide easily through the water, and cannot be caught readily by their enemies. Why are they so long and slim, and why do they have a pointed nose? Is it easy or hard for a person to move in the water?

What do we call very small fishes? Like chickens, fish come from eggs; but the mother fish does not sit on them to keep them warm until they hatch. Is a live fish cold or warm?

The mother generally goes up the stream, or to a place where the water is shallow or safe, and there lays a great number of eggs. She then goes away and perhaps never sees her young after they are hatched. The little ones at first move about slowly and do not go far away. They live

on the eggs from which they themselves came, until they grow big enough to hunt food for themselves. When they venture out from the quiet, shallow home, many dangers meet them. Some are eaten by big fishes, but others grow to be large. Most fishes move about in great companies called "schools."

If possible, have a live fish in the schoolroom, that the pupils may note its shape, movements, and ways of eating, breathing, etc.

LESSON XV

BILL OF FARE

Mention foods that we eat for breakfast; for dinner; for supper. What foods do we have in summer which we do not have in winter? Why? What foods do we eat raw? What foods are cooked before being eaten? Can you give any reason why such foods need cooking? How does cooking affect them? In what ways may foods be cooked?

Which foods grow in the garden? Which grow on trees? Which grow in large fields? Do we get any foods from the ocean? from the rivers? From what animals do we get beef? mutton? venison? veal? Mention other animals, the flesh of which is good to eat. Mention other animals which are not used for food.

At what time of the year do we eat most meat? In what season do we eat most vegetables? most fruit? In the far north the people live mostly upon meat, as it is so cold. In the far south they live mostly upon fruits, because it is so warm. What does the cat eat? Name all the animals you can, and tell what kind of food each eats.

HOME ACTIVITIES — PREPARING LUNCHEON

Third grade pupils preparing a luncheon for first grade pupils.
University of Utah Training School.

HOME ACTIVITIES — SERVING LUNCHEON

LESSON XVI

FOODS AND DRINKS

What foods are wholesome? What foods are not? Were you ever made ill by eating any particular kind of food? How do you feel when you have eaten too much? Discuss the evil effects of eating too much pastry or candy, and why only a little is furnished the children by their parents.

What drinks do we most commonly use? Are water and milk wholesome? Why do we not drink as much soda water or root beer as we do water? Is much soda water good for us? Will animals drink soda water? Most of them drink water and many of them milk, but they refuse things which destroy the health.

Little need be said about the use of tobacco and of liquors until the children are old enough to be subject to these dangers.

At the proper time a talk may be given upon etiquette at the table.

LESSON XVII

THE "GREENGROCER"

By means of a story or class discussion, bring out and make a list upon the blackboard of the foods we get from the greengrocer. Visit his store. Recognize the many fruits and vegetables displayed there. Which require cooking? Which may be eaten raw? Distinguish between fruits and vegetables. This will afford a most interesting and profitable discussion. Which are often dried? From which do we make jelly? cider? wine? pickles? raisins? etc.

Which are sold by the dozen? by the pound? by the bushel? by the box or crate? Find out the prices. Where does the greengrocer get them? Which will spoil quickly? Which will keep a long time? Which grow in this vicinity? Which have you seen growing? Describe the plants bearing them. Which come from elsewhere? Where?

LESSON XVIII

THE FALL GARDENER

If possible, have a school garden, for from it the pupils will learn many valuable lessons. It will also afford them much educative activity. Visit a good market garden, and let the pupils ask many questions about the plants growing there and the treatment they have received. Discuss the garden as a source of supply for the greengrocer.

What seeds are planted in rows? in hills? How are the weeds kept out? What harm do they do? How is the garden watered? Find out how and when the various products are gathered, how they are measured, tied into bundles, boxed or crated for the market. Will any of the crops remain in the ground during the winter? What preparations are being made in the garden for winter?

LESSON XIX

WILD PLANTS

Take the pupils out for a field lesson to study wild plants. Count the number of plants found on a given area, — say a square yard. Name as many of them as you can. Note the condition of growth, whether in bud, in blossom, or bearing

seeds, etc. Which have finished the season's work and died? Which are young and just beginning to develop? Are some dying before they have borne seeds? Account for this. Are some thriftier than others? Why? Compare plants of the same species that have little water with those having plenty. Note the difference in size and general development, and thus show the need of water.

In like manner show the need of sunlight. Plants under the shade of a tree, house, or other obstruction do not thrive. Note the effects of overcrowding. Which are killed by overcrowding? Why?

Are these wild plants of any use to man? As successive crops grow year after year, die, and decay, they greatly enrich the soil and prepare it for man's use. Sagebrush, so common in arid regions, is a good illustration. Make a special study of it in this connection. How rich the soil is near the sagebrush where the leaves have fallen, decayed, and mixed with it!

Most wild plants, when growing with cultivated plants, become a nuisance and cause the farmer much labor to remove and keep down. Have any of the pupils aided in weeding the garden? What is the effect upon the crop if the weeds are allowed to grow?

LESSON XX

PLANT RELATIONS TO WATER

Let the pupils visit a swampy place, also a piece of dry bench land or upland, and study the plants found in each place. Collect samples of water plants and land plants for use in the schoolroom.

Compare separately, the roots, stems, and leaves of the flag, cat-tail, bulrush, water cress, etc., with corresponding parts of sagebrush, greasewood, bunch grass, sunflower, cockle-bur, or whatever dry-land plants grow in the vicinity. Note how large, plump, succulent, and watery are the first, and how dry, tough, slender, and fuzzy are the latter. Account for each of these peculiarities in the terms of their water relations.

NOTE. — Plants in arid places need longer roots to reach the water. Since evaporation takes place chiefly in the leaves, they will have fewer and smaller leaves, often covered with protecting fuzz. Their stems and branches are dry, slender, and tough. In all these particulars the water plants are quite the opposite, to correspond with their difference of condition.

Show the pupils unfamiliar specimens, and let them determine if they are swamp plants or desert plants from their general structure.

Experiment with the growing plants, by giving some too much and some too little water.

LESSON XXI

THE HOUSE FLY

What do the house flies like to eat? How do they eat it? Describe the mouth of the fly. How many legs has the fly? Why is it so hard to catch? Examine its eyes: how large they are! Look at them through a large lens. A fly can see in all directions at once, for it has so many little eyes.

How do we get rid of the flies? Discuss the use and danger of poisonous fly paper: uses of sticky paper; of screen doors and windows.

Did you ever see any little baby flies? Where do flies come from? They come from small worms or maggots which live in wet, filthy places, and if we wish to keep free from them, our dooryards, stables, etc., should be kept clean and dry.

If possible, get some larvæ and pupæ of the common house fly for study, and let the pupils see in what kinds of places they are found. That the fly is full grown when first hatched also should be learned from observation.

LESSON XXII

DOMESTIC ANIMALS — THE CAT

Of what use is the cat? What does she eat? How does she capture her food? Find a good reason why the cat should have the following features (lead the pupils to suggest the features): sharp teeth; a rough tongue; sharp claws which are sometimes extended, but generally withdrawn; eyes to see at night; noiseless foot pads; whiskers that extend outward about as far as the width of the body; a slender, agile body, etc. Discuss the habits and intelligence of the cat.

Kittens are born blind, receive their sight when about nine days old, and afterwards can see at night. Does the cat do any harm to the birds? Does she do more good than harm? How may we prevent her doing harm? Describe the cat's movements, noise, etc.

Tell stories about cats, illustrating their habits and intelligence. Encourage the pupils to relate what they have observed and to observe more closely in the future. Have a game of "Pussy wants a corner" for the rest period. Draw or paint a cat. Model one in clay.

FIRST GRADE — WINTER WORK

LESSON XXIII

DOMESTIC ANIMALS — THE DOG

Describe different kinds of dogs. Teach the pupils from living animals and pictures to recognize some of the most important species of dogs. Discuss their size; shape; structure; food; teeth; smell; speed; uses; intelligence; etc.

Children are easily interested in animal stories, and if the stories are told in the right way, many of the habits and characteristics of animals may be vividly, though almost unconsciously, impressed upon their minds. Stories of this nature also create in the children a kindly feeling toward animals. Schoolbooks are full of stories about dogs.

Draw, paint, or model in clay, a Newfoundland dog; a greyhound; a rat terrier. Make a dog kennel out of paper.

LESSON XXIV

DOMESTIC ANIMALS — THE COW

How many of you have seen a cow? How many of you have one at home? What is a cow good for? Describe a cow. Describe a calf. How do we obtain milk from a cow? Who has seen a cow being milked? What do we get from milk? How is the cream separated from the milk? Discuss the products of the cow, how obtained, and for what used. Several lessons may be devoted to this subject, and a very interesting and useful chart may be constructed by the teacher with the aid of the class.

Small glass bottles may be filled with the following products and hung upon a card as they are discussed in the class: milk; cream; butter; cheese; rennet tablets; gelatine; glue; neat's-foot oil; tallow or fat, etc. A tuft of plasterer's hair, a horn comb, a bone button, a piece of leather, also may be grouped with the other products, each article being discussed and its use and preparation explained as far as the little ones can understand, as it is added to the chart. All can draw or paint a cow and a calf, and the best one may be pasted upon the chart.

Discuss the nature and intelligence of the cow; her disposition; her food, shelter, and care. If convenient, visit a dairy, a cheese factory, or a tannery, and study the activities observed.

A separate lesson may be given upon the manufacture and use of each of the cow products mentioned.

A good encyclopedia will describe these things and the processes connected with their manufacture.[1]

LESSON XXV

DOMESTIC ANIMALS — THE HORSE

How does the horse serve us? Describe his harness. Name his parts. What does he eat? How does he put his food into his mouth? How does the cow? the cat? the squirrel? the hen? Compare the speed of the horse with that of the cow. Compare their respective peculiarities, mouth, teeth, tongue, covering, feet, height, uses, etc.

[1] "Stories of Industry," Educational Publishing Co.; "Great American Industries," A. Flanigan Co.; and "Information Readers," Boston School Supply Co., are excellent books upon these subjects.

BLACKSMITH AND FIREMEN

Dramatization of social activities related to nature study lessons.

Show pictures of horses. Compare the heavy draught horses with the fleet coursers, and show adaptation to speed and work habits. Discuss the care, shelter, and intelligence of the horse. Tell stories illustrating his peculiarities.

Draw, model, or paint a horse. Make a nose sack; a pair of hobbles; a halter. Read about lassoing wild horses. Make a shed or stable of cardboard.

LESSON XXVI

THE WEATHER

What changes have gradually taken place in the weather since school began? Can you play as long after school before sunset as you could then? What change has taken place in the length of the day? How has the cold weather affected the birds and insects? How has it affected the trees

FIRST GRADE CALENDAR

(See Calendar, p. 31.)

and shrubs and the school garden?

What do we do to provide for the cold weather? Discuss the changes made in and about the house — in food, fuel, clothing, bedding, etc.—as compared with what is used in the summer. How are fruits and vegetables preserved from freezing?

What games do we play in winter? What tradesmen are very busy in the winter and not in the summer? What ones work hard all summer, but have little to do in winter?

Draw or paint a summer scene; a winter scene. Make a chart of pictures illustrating fall; another illustrating winter.

LESSON XXVII

WEATHER IN OTHER LANDS

Why is it colder now than it was a few months ago? Where is the sun now? Where was it then? What kind of weather do you think it is way down south where the sun

is now? They have no winter. What kind of houses do they have there? What kind of clothing do they wear? Trees there bear fruit all the year. The birds go there to spend the winter.

Show pictures of tropical countries, people, fruits, etc., and thus give the little ones an idea of conditions there and the influence of weather upon vegetation. Treat only such features as may be compared with similar features here.

While the sun is away to the south, what kind of weather do they have in the far north? What kind of people live there? What is their food? In what kind of houses do they live?

With the aid of comparisons made with winter conditions here, good pictures, stories, etc., give the pupils an idea of animals, plants, and conditions in the frigid zone, connecting the position of the sun as the chief cause.

LESSON XXVIII

ANIMAL PREPARATIONS FOR WINTER

What do we do to keep warm in the winter? Can the horse or the cow keep warm in the same way? How does nature prepare them to be comfortable in winter? Are the feathers of the chickens any thicker or warmer in the winter? Let the pupils see, if possible, the heavier covering of our winter dwellers, for cold weather; and recall the fact that they *shed* their hair or feathers when warm weather approaches.

What do we do to help keep these useful animals warm? Describe a stable; a manger; a chicken house; a dove house, etc., and make some from cardboard. When and why do

we blanket a horse? Do we turn the horse out in the pasture in winter? Why not? Discuss the care of domestic animals in winter as compared with that necessary in summer.

LESSON XXIX

THE MOON

Is there a moon to-night? Describe it. Is it always the same? Does the moon shine the same every clear night? Who has seen it rise? Who has seen it set? Did it look the same when you saw it set as it did when you saw it rise in the evening? Of what use is the moon? What changes does it pass through?

Have the children observe the moon for a month, and report frequently. Let them draw or cut from yellow paper the shape of the moon each day when it is visible to them, and place these forms on a chart to show the successive changes through which it passes in a month. At new moon is a good time to begin this work. The children will be delighted with their discoveries, if this work is done in the right way.

Does the moon give us heat like the sun? How does its light compare with the sun's light? How often do we have new moon? How long is there no moon?

LESSON XXX

A SNOWSTORM

Have the children observe the conditions that precede and accompany a snowstorm. Note the direction of the wind, the kind of clouds, the temperature, etc. If it snows

during school hours, let them go out and watch the flakes fall. With a few lenses examine the flakes. These may be caught for that purpose upon a slate or piece of glass, which should be as cold as snow so that the flakes will not melt too quickly. Under very favorable conditions, the pupils may be able to see the beautiful symmetry of the crystals. Usually, however, the crystals are mutilated in falling. Their crystalline structure, at least, is easily seen, and the pupils will be much interested in the lesson.

As flake after flake falls, the snow becomes deeper and deeper. Measure the depth after it has ceased to fall; then, in a rain gauge or other tin vessel, melt what may have fallen, and see how much depth of rain the snow would make. It takes a depth of eight or ten inches of snow melted to make one inch depth of water covering a like area.

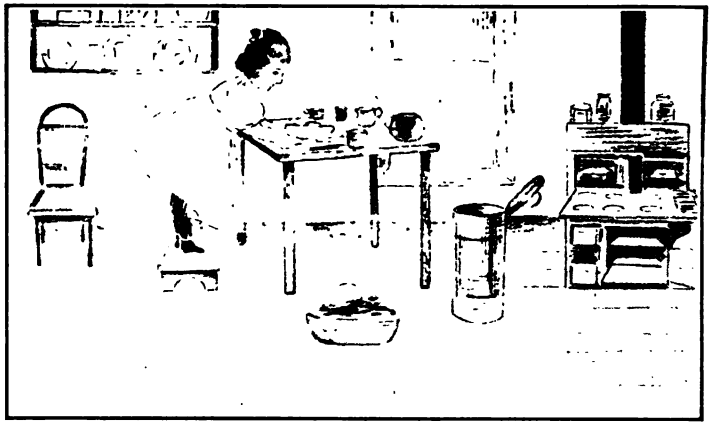
What becomes of the snow? Where does it melt first? Where does it melt last? Where does it never melt? What becomes of the water from the snows that melt in the mountains? For what do farmers in the arid regions use this water? Do you know of any cañon stream fed by melting snows? When do the snows melt mostly? Do we have rain during these warm months? What a blessing that the storms of winter bring snow instead of rain!

LESSON XXXI

OUR HOME

Name the different rooms in your home. Which is the best one? What is the parlor used for? How is it furnished? How is it decorated?

What is the kitchen used for? What furniture belongs in the kitchen? Discuss in a similar way the dining room;



THE KITCHEN AND ITS USES

Charcoal drawing to be copied by the pupils.

pantry; bedroom; bath room; halls; closets; cellar; garret, etc.; bringing out the use of each, its contents and furnishings, and the proper deportment of the children when using any of them.

Make from cardboard, furniture suitable for the different rooms described.

Building a house from a packing box, making halls and partitions for the various rooms, and papering them with suitable remnants of wall paper (furnished by the children, if possible), will afford much educative activity and correlated work. Let the children also *play house.*

LESSON XXXII

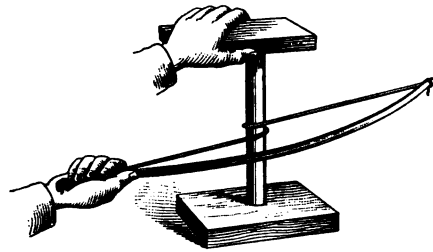
HEATING OUR HOMES

How do we warm our homes? Describe a stove; its parts. Tell the use of the legs; the ash pan; the air chamber; the

fire box; the grate; the door; the damper; the stovepipe; the chimney. What would be the result if any of these parts were lacking? How do we make a fire? How do we keep it from burning too fast? Is a grate somewhat like a stove? Describe a grate; a furnace; a range; a heater, etc.

What do we burn in our stoves? Where does the wood come from? the coal? Have you seen a gas stove? How is it used? Describe one.

Describe primitive ways of making a fire and cooking. Show pictures of old-fashioned fireplaces, etc.



A Fire Drill

A fire drill may be made by fitting a round piece of wood, eight inches long, into cone-shaped holes bored partly through two blocks of wood, as shown in the cut. The heavy string of a bow is wrapped around the upright, which is made to revolve rapidly as the bow is drawn back and forth. The bearing in the upper block may be greased to prevent friction, but the lower one is left dry. Downward pressure on the upper block will increase the friction in the lower bearing. In this way the pupils can produce sufficient heat to color the wood and make it smoke, if they cannot make it burn. Indians produce fire in this way.

Two sticks rubbed rapidly together cause great heat. This is the method the Indians used for making a fire. Let the pupils try to make a fire in this way. Make a fire drill in the manual training room.

LESSON XXXIII

LIGHTING OUR HOMES

How does light get into our homes in the daytime? What do we use to shut out the light when we do not want so much? What do we have to keep out the cold and at the same time

let in the light? In olden times people did not have glass, and therefore made the windows very small, and sometimes had none in their houses. Should you like to live in such a house?

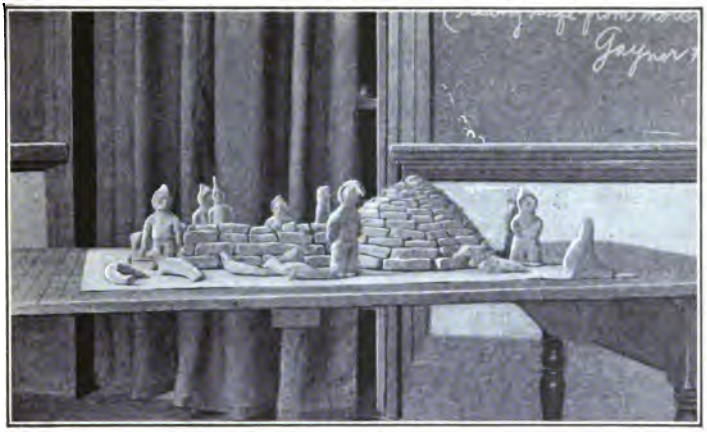
How do we light our homes at night? Discuss the electric light, gaslight, common oil lamp, old-fashioned candle, and the pine knot and fireplace as means of lighting the home, showing how much advancement has been made in these things.

LESSON XXXIV

OTHER PEOPLE'S HOMES

Where is the sun now? Where is it in the summer time? Where is it summer now? In tropical countries it is never winter, as it is here. Birds and flowers and fruits are seen there all the year round. What kind of homes do you think they have in such countries? Do they need houses as thick and warm as ours? Many live in bamboo houses, open on all sides except during a rain, when the sides unroll like a curtain and keep the wind from blowing the water in.

Show pictures and tell stories about the tropics. Cut from cardboard, paint, or draw homes of the tropics. Use straw for bamboo, and make a bamboo house for busy work. In a similar way treat the Eskimo hut and the manner in which Eskimos keep warm when the sun is so far from their country. Show that huts similar to those of the Eskimo can easily be made. Likewise, many pictures of the land of the north can be shown to the children to give them an idea of the homes of other people, and why they are not like ours.



CLAY MODEL OF AN ESKIMO HOME

Made by first grade pupils of the University of Utah Training School.

AN ESKIMO SONG

The jolly little Eskimo
Rides across the ice and snow.
He drives from morn till night
And snaps his whip with all his might.

Although his home is made of snow,
Although the icy winds may blow,
The furs he wears protect him so
That he's not cold at all, you know.

LESSON XXXV

MAKING A HOUSE

Visit with the children a building in process of construction. Notice and name the different kinds of material used

and the purpose of each, *e.g.* sand; lime; stone; brick; lumber; laths; nails; shingles; glass; paint; tin; sheet iron, etc.

Call attention to the manner in which all these things are put together to make a house. In laying stone and brick, why do they "break the joints"? Why do they "tie" the different tiers of brick together? Why is the flooring "tongued and grooved"? How are the shingles laid? How much of each one is exposed to the weather? Why do they break joints in laying shingles, also? Why are such great cracks left between the laths? How does the mortar hang on to the walls?

If the house is near the school, several visits to it should be made and the different processes followed through their various stages.

Teach the pupils the names of the different parts of a house, as: foundation; walls; floor; roof; joists; rafters; studding; sheathing; sills; lintels; casings; doors; windows, etc., and the use of each.

A small house of logs, or adobe, or lumber may be made, patterned after the one observed.

FIRST GRADE — SPRING WORK

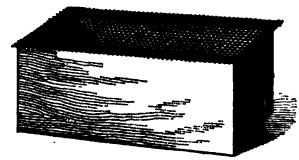
LESSON XXXVI

ANIMAL HOUSES

Let the pupils find homes of various animals. Get a bird's nest; study its structure. Of what is it made? Where does the bird get the material used? How does it build so neat a

home without hands? Does the bird live in it all the year? Would it make a warm winter home?

Find a cocoon, put it into a larvæ box, and keep it until the insect hatches out. Study an ant bed, a wasp's nest, or the home of any wild animal that may be brought by the children, or found near the school.



A LARVÆ BOX

A chalk box covered with a piece of wire cloth held in place by a few small tacks will form a convenient receptacle for insects and their larvæ. If one end is taken out and fitted so as to form a door that slides up and down, it adds much to its convenience.

Many facts about the lower animals may be told while studying their homes. A hive of bees would be an instructive acquisition for the pupils of any grade. The homes of spiders, crickets, beetles, earthworms, etc., should be studied.

LESSON XXXVII

SPRING AWAKENING

Compare the weather now with what it was a month or two ago. Are the days changing in length? Where does the sun rise now? Where did it rise in the winter? What makes it warmer? Are any plants growing now? Have any of the birds returned from their winter home? Name any seen. What do they eat? Are there any bugs, ants, or flies yet? Which is the first flower in bloom? Where is it found?

Do we wear our overcoats now as much as in the winter? What other changes can you see that indicate that spring is here and warmer weather is coming? Note when the buds on the trees begin to burst. When the bark begins to peel, let the boys make willow whistles. What makes the bark peel?

Which trees blossom early? Which blossom late? Which come first, the blossoms or the leaves?

From the leaves, flowers, fruits, etc., studied in the spring, lead the pupils to make original designs for borders, panels,

ORIGINAL ART DESIGNS
Taken from nature study lessons by pupils of the Utah Normal Training School.

pillow covers, and other kinds of art work. This will develop in a most effectual way the true conception of art, and at the same time add interest to nature work.

LESSON XXXVIII

COMMON ROCKS

Have the children bring to school as many samples of common rocks and pebbles as necessary, and study them. Teach the pupils to recognize sandstone, limestone, granite, marble, quartz, onyx, and other building and ornamental stones.

Test the hardness and fracture of these stones, and learn for what each kind is used.

What kinds are too hard to be shaped easily? Which ones are too soft for foundation? Mention some that are soft enough to be cut readily with stone chisels, yet hard enough to be used for steps or foundations to buildings.

Visit a limekiln, stone quarry, or marble works and see how these stones are obtained and prepared for use.

Notice the colors of the different kinds. Strike two stones together and see if any odor is emitted. Which kinds are used in building houses? For what parts of a house are they used?

Where are building stones obtained? Describe or visit a quarry, and explain how rocks are split open with great accuracy by drilling holes in rows along the line where it is desired to split the rock and by putting into these holes slips and wedges. What stones have a grain or cleavage? Which stones break equally well in any direction? Is this an advantage or disadvantage in building stone? Why? Visit a stone yard or marble works, and see how stones are cut, chiseled, dressed, polished, etc.

LESSON XXXIX

COMMON ROCKS (Continued)

What is the chief use of limestone in building a house? Break off a splinter of blue limestone, and with a flame and blowpipe burn it until it becomes lime, if possible. Moisten it and note the change it undergoes. Visit a limekiln and see how lime is burned on a large scale.

Test stones by putting small fragments of them into acid. Strong vinegar will answer, but hydrochloric acid is better.

Even a drop of the latter poured upon a piece of limestone will produce effervescence. This indicates limestone. An odor similar to burnt powder, where two rocks are struck together, indicates a silicate, generally the hardest of common rocks.

If possible, visit a cliff and a stream and gather fragments of the talus from the former and pebbles from the latter. Compare their shapes. Why are the rocks recently broken from the cliff angular and irregular, while the pebbles are rounded? Discuss erosion, especially as seen in our mountain streams.

Experiment. — Fill a strong bottle with clean pebbles, washed until the water used is perfectly clear. Then shake them vigorously with the clear water for one minute or more before the class, and note how dirty the water becomes. Discuss how the water became muddy. Pass it through a filter, and show how much dirt was ground off in only one minute. Consider the effect of continuous wear.

Describe a marble mill where toy marbles are made from stones. The stone from which marbles are to be made, is first broken into little blocks, all of about the same size. These blocks are placed in a large cylinder, or drum, which is made to revolve day and night while a stream of water passes through it. The pieces of stone within the cylinder are thrown against each other, much as pebbles in a stream, and in time they wear away all corners and edges, and when taken out are almost perfect spheres. In the marble mill only one kind of stone is used at a time, and the pieces, being uniform in size and hardness, wear away in a more uniform manner than the pebbles in a stream, where all kinds and sizes are mixed, and the wearing motion is very irregular.

LESSON XL

STUDY OF SOILS

Are all soils alike? What differences can you notice? Take the class out for a walk, and in different places gather samples of soil; on returning, put these samples into glass bottles so that they may be examined easily and continually by the children. Dig a hole as deep as need be to secure samples of soil, subsoil, etc., and place a layer of each kind in a tall bottle in the order that they occur in the earth.

Does much vegetation grow on gravelly soil? Is it good or bad soil, then? Is sand a good soil? Is clay a good soil? Which of all the samples do you think is the best soil? What kind of soil is found on the hills near the mountains? Where is sandy soil found? Do you know where there is much clay in the soil? Where is the best soil found near the school?

Notice the weeds and wild plants that grow on these different kinds of soil, and tell which is poor and which is good soil. Why do farmers greatly desire good soil for their farms? The teacher should illustrate, by examples and experiments, the benefit of having good soil to cultivate. Seeds planted in clay, sand, and in good garden loam, in the schoolroom, and given the same care will show the relative values of the soils used.

LESSON XLI

STUDY OF SOILS (Continued)

Experiment. — Wet samples of soils secured on the field trip, and notice which readily absorb the water. Let them dry, and notice which have a hard crust and which have not.

How could a young sprout get through the hard crust? Note the difference in color. Usually a dark-colored soil is the best.

Examine with a lens a sample of good soil. Note the grains of sand, the particles of clay, and bits of sticks or leaves. How do farmers make the soil better when it is poor? How do they prepare it for planting the seed? How does plowing benefit the soil? What time of the year is the ground most easily plowed? How does the frost loosen the ground? The frost is nature's plowman, and in the spring it leaves the soil light and fine, — a fit bed for young and tender plants.

LESSON XLII

ASTRONOMY

Teach the pupils to notice the change in the length of the day. Observe the time of the setting and the rising of the sun until a change is noticed. Perhaps the pupils can recall that they get home from school much before sunset now, and that their fathers may get home from work before dark. Use any apt illustration to fix this truth.

A little effort on the part of the teacher will enable the pupils to learn some of the stars; for example, the evening and morning stars, the north star, the big dipper, the milky way, etc. Short talks occasionally about the sun, moon, and stars will be an agreeable change, and stimulate observation and inquiry. Read some of the beautiful myths about stars and their groups.

Should a visible eclipse of the sun occur during school hours, provide pieces of smoked glass for the pupils and allow them to observe it. They may see the moon pass between us and the sun and the effect produced.

LESSON XLIII

THE SEASONS

Name the four seasons. Why is this season called spring? Where do the pretty flowers and grass come from? Describe the weather during springtime. What do animals do in the spring? What games do you play then? What changes occur in plants and trees in the spring? What tradesmen that were idle during the winter now have work?

What comes after spring? How is the weather in the summer time? It is too hot to keep school, so we have a long vacation. How do people keep cool in the hot weather? What sometimes happens when people become too warm? Do plants like warm or cold weather better? What fruits ripen during the summer?

After summer comes fall or autumn. Why is it called fall? What happens to the fruits and leaves? What fruits do we get in the fall? Describe many ways in which fruits may be prepared for our use in winter. What games do we play in the fall? How is the weather then? When does school begin?

What is winter like? What games do we play? What animals are seen in winter? What is the condition of most all trees and plants? How do we keep warm during the winter? Which season do you like best? Why?

Paint a spring scene; a summer scene; a fall scene; a winter scene.

NOTE. — A number of lessons may be made upon this topic, — at least one upon each season. They may follow each other in succession, so as to compare the seasons, one with the other, or one or two lessons may be given at or near the beginning of each season, direct attention being called to the activities and conditions present.

LESSON XLIV

BUDS

Just before the early buds of spring begin to burst, ask the pupils to bring samples of various kinds to school. Note their arrangement on the twig.

Which are covered with scales? Suggest a reason. Which are covered with a fuzz? Are any covered with gum? Is the gum soluble? Taste it. Do you think insects would like to eat buds covered with bitter gum? What do you think is within the buds? Place them in a bottle of water for a few days, and note what happens. Which kind burst first? Which buds contained leaves only? Which contained blossoms?

Smell of the blossoms, and learn to distinguish flowers by their odor.

Which develop first in the orchard, the leaves or the blossoms? Do all buds on the trees develop in the spring? Where are most of the dormant, or undeveloped, buds found? Why do more buds grow on the outer ends of the twigs?

Paint or draw twigs of various kinds, having buds in different stages of growth.

LESSON XLV

THE SCHOOL GARDEN

Many lessons upon the school garden may be given during the spring, and several during the fall, if the garden can receive proper attention during vacation.

The following steps may form the basis of many lessons, and are accompanied easily with appropriate activities for children, which they never fail to enjoy: —

WILLING WORKERS IN THE SCHOOL GARDEN

First. — The selection of a suitable spot and clearing of any weeds or rubbish found on it. In making the selection, consider: (*a*) quality of soil; (*b*) chance of sunlight; (*c*) how it may be laid off with a view to utility, beauty, and convenience.

Second. — The preparation of the soil. Many willing hands will be glad to engage in this labor.

Third. — Securing a supply of seeds and selecting what shall be planted. Let the children bring all the seeds they will, and if others are needed, the teacher can get them. In deciding what seeds to plant, consider: (*a*) when they will mature, preference being given to earlier maturing plants so that the pupils will get the benefit of their gardens before vacation time; (*b*) the proportion of flower seeds to other seeds; (*c*) seeds to be experimented with.

Fourth. — How to plant the procured seeds. Consider: (*a*) how the rows must run to be irrigated, unless the garden hose or rain is depended upon to supply the needed moisture; (*b*) which shall be given to flowers and which to other seeds; (*c*) the order of blooming of the flowers and the growth of the plants, — the taller plants should not overshadow the low ones; (*d*) whether to plant them in hills, rows, or broadcast, and why; (*e*) convenience for hoeing, etc.; (*f*) general beauty of the garden when growing.

Fifth. — Let pupils take turns in irrigating, hoeing, and caring for the garden. At proper times discuss in class things noticed by the pupils in their observations in the garden. They will soon learn to notice other gardens, visit greenhouses, and perhaps plant flowers at home.

PRODUCTS FROM THE SCHOOL GARDEN

At the proper time perhaps a sufficient quantity of radishes can be pulled from the school garden to put on the table,

where all may eat luncheon together, and thus have some practical benefit of their labors in the garden. Or a beautiful bouquet of flowers may adorn the teacher's desk, when the garden has had time to produce them. This will add much to the interest of the work.

LESSON XLVI

A VISIT TO A FARM

Having done some planting themselves, the children will be desirous of seeing how this work is done on a larger scale. If possible, give them an excursion to a farm at a time when the planting is being done. Let them see how the land is plowed and harrowed, and how the various crops are planted.

This may be followed by descriptions of old-fashioned methods of cultivating the soil, and illustrated with pictures of primitive methods of farming. From a dealer in farm implements many pictures of plows, harrows, drills, seeders, etc., may be had as advertising matter and used to illustrate to the children how much better this work is done now than it used to be, or than they did it in their school garden.

LESSON XLVII

FARMS IN OTHER LANDS

Mention the crops that grow on farms in our country. Make a list under vegetables, fruits, grains, etc. What vegetables have you seen in the market that did not grow on a farm in this country? What fruits? What grains? Let the pupils discuss these products as best they can. The teacher may add much to their knowledge by good samples, pictures, and descriptions.

LESSON XLVIII

FARM ANIMALS

Mention the useful animals on the farms in our country. Discuss the horse; the work he does, and the care he should receive. Likewise consider the cow, pig, poultry, etc., and their respective uses to the farmer, dwelling longer upon points most familiar and interesting to the pupils. Good pictures should be used to convey correct impressions of these animals and their different varieties.

The domesticated animals of other countries may then be considered. The elephant, camel, llama, etc., of the warm climes, and the reindeer, Eskimo dog, etc., of colder countries, may be discussed in a similar way, illustrated with good stories and pictures.

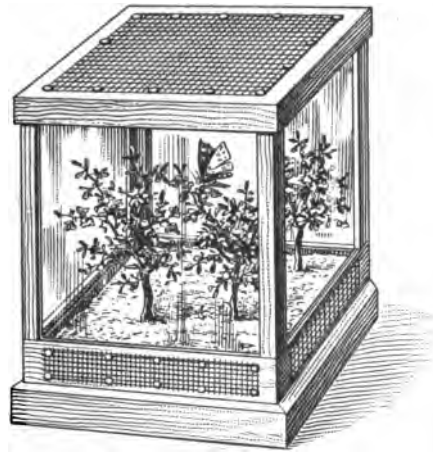
ANIMALS OF OTHER COUNTRIES

Modeled in clay by first grade pupils of the Utah State Normal Training School.

LESSON XLIX

INSECTS

Cocoons procured in the fall or spring may be kept in a larvæ box and allowed to hatch in the schoolroom. This will afford the best opportunity to explain the metamorphosis of the insects.

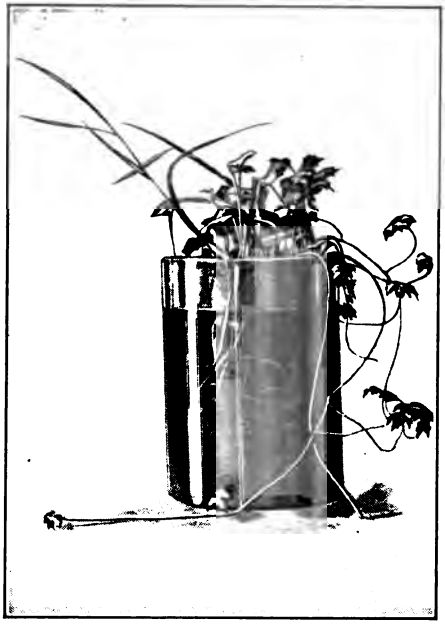


An Insect Box

A glass insect box large enough to contain living plants upon which larvæ may be fed, can be made for about three dollars. The top is a movable lid covered with wire gauze; a strip of gauze is placed also around the bottom, to secure proper ventilation. The sides are of glass. The bottom, a metal tray, contains sufficient earth for the needs of the plant. Here the complete metamorphosis of different kinds of insects may be watched by the children.

Any large glass jar may be made to serve as an insect aquarium, giving the pupils opportunity to observe water forms of animal and plant life. Keep it well supplied with both kinds of life, changing the samples from time to time according to the season.

Have the pupils count the legs of insects: tell how they walk, hop, or climb; describe their wings and flight; examine



AN INSECT AQUARIUM

their eyes, mouth, antennæ, etc. What do they eat? Is their color like the plants upon which they are found? Do any of them bite or sting?

LESSON L

A PLAY STORE

As educative, perhaps, as the school garden is the play store. Here materials of various kinds known to children may be represented for sale. They will bring many things from their homes to fill up the shelves. Make money in all its denominations from cardboard, get scales and measures, and learn their proper uses. What the store means to the home, the play store may be made to mean to the school, and through it the child may learn to realize some of its most important social relations, besides much arithmetic, geography, and science of the most practical kind.

Lettering and sign writing, advertising, marking goods, etc., and some understanding of the profits of merchandising and its conveniences are all called for in this connection.

SECOND GRADE

SUGGESTIONS TO THE TEACHER

Basis of Second Grade Work. — Since the pupils of this grade are so near in age to those of the first grade, the principles expressed in the "Suggestions to Teachers" of the former grade apply with almost equal force to this one.

While the lessons may be repeated to young children with less harm than to older ones, the author believes it much better to provide mostly new work for each grade, and where some thoughts that were brought out in the first grade may be found in work given for this one, they will be found usually in new relations.

The lessons of the first grade are confined chiefly to the home environment and activities, because the pupils of that grade have little else to build upon. In the second year the experience of the child has been enlarged and his horizon extended. He is now capable of feeling some of the needs of the home and learning how they are supplied. He can now consider *the home as a shelter*, made necessary by the conditions of the weather: and, by sympathy, can see also the needs of animals for shelter. He can study the garden and the store as the immediate sources of supply for home needs, and the farm and the orchard as more remote ones. Many of the simpler forms of manufacture — the transforming of raw materials into useful things — will interest him, and afford much educative activity. On these topics, then, the second grade work is based, forming a unifying element around which most of the other work may correlate.

SECOND GRADE — FALL WORK

LESSON I

A RAIN STORM

WHEN conditions indicate a rain storm, have the pupils watch its development. Place a square pan — a common dripping pan will do — out where the rain will fall into it. A deep rain gauge is better. After the rain, show the pupils how much water fell into the pan. Measure its depth. Pour it into a pint, quart, or gallon measure, according to the amount caught.

Some excellent number work may be given here to aid the children to understand what a rain storm means. How much fell into the pan? How much would have fallen into two such pans? How much would have fallen into a pan as large as the desk? Compare the areas of the pan and desk. How much fell upon a space as large as the floor? If a pint of water weighs a pound, the answers may be given in pounds, keeping within the capacity of the class.

Whence comes all this water? What brings it here? The rain comes from the sea in the form of clouds carried along by the winds. Think of how much water fell upon the lawn and garden, the streets and fields, and upon all the valley. How many sprinkling wagons would it take to bring that much water?

Let the children go out and dig in the ground in various places and find out to what depth the rain penetrated the soil. See if it soaked in the same distance in all kinds of soil, and why.

Which will be the more benefited by the rain, the grass

or the trees? If this be one of the first fall rains and in an arid region, the pupil may be led to see how the rain makes the grass grow after a hot, dry summer, and gives food to the flocks and herds, from which we, in turn, get food and clothing.

LESSON II

THE WEATHER A CAUSE FOR SHELTER

Why do we build homes? How are they arranged to shed the rain and snow? Examine the shape of the roof, and notice how the shingles are laid. How may our homes be made cool in summer? How are they arranged to keep out the cold in winter? Discuss the uses of doors, windows, and transoms.

What kind of home do the people in hot countries have? Show the pupils pictures of houses in the tropics. Would they serve our needs here? Why not? Discuss their structure and their adaptation to the weather there.

What kind of homes do the Eskimos build? Show pictures of these, also. Why do they build such houses? How would such houses serve our needs? In our country what kind of house is coolest in summer? What kind is warmest in winter?

What shelters should be provided for our useful animals? Discuss briefly the construction and use of the shelters for domestic animals. Do any of the wild animals secure a warm shelter for winter? The pupils will doubtless mention some of our burrowing animals, and some that live in dens and hollow trees. With the aid of pictures, stories, and descriptions show them how many winter dwellers contrive to secure a warm shelter for winter.

LESSON III

THE WEATHER A CAUSE FOR CLOTHING

What changes shall we soon make in our clothing? Discuss winter clothing: cotton and woolen clothing, underwear, overcoats, rubbers, overshoes, umbrellas, storm coats, etc., and the conditions which make them necessary. In like manner discuss summer clothing: straw hats, linen coats, suits, etc., white, thin dresses, parasols, fans, etc., and conditions which make them necessary.

Discuss also such animal coverings as undergo change in accordance with the weather. When is the wool cut from the sheep? What change takes place in the hair of a dog, cat, horse, cow, etc., in the fall? in the spring? Why? Do any animals change the color of their coat at the same time? Can you think of any reason for this? Do birds change their feathers? Show the pupils the warm, downy feathers that grow near the skin of many fowls to keep them warm in winter. Tell them about the eider duck and the down procured in Iceland and other cold places.

LESSON IV

ANIMAL SHELTERS

Describe a model stable and the winter care given a horse. Compare with a henhouse, and note the arrangements for the needs of their respective occupants. What would be the result if the horse were turned into the pasture and the chickens allowed to roost in the trees all winter? Why are these shelters necessary for our useful animals?

Mention wild animals which have some kind of shelter during winter. Discuss the ones mentioned by the pupils, and show how they are adapted to the needs of their occupants. Make a special study of a few typical examples. The gopher, prairie dog, beaver, and bear, as well as many of the insects and smaller animals, secure in various ways a protection from the cold of winter. The woodpecker makes a nest in a hollow tree, where it remains most of the year. The swallow builds a mud nest under the eaves, where it rears its young, but, like most birds, it migrates to the south to spend the winter.

Many wild animals, however, seem to prepare no shelter, and take whatever accident may provide. Snowbirds often bury themselves in the snow to pass the night. Many animals perish because they cannot provide themselves suitable shelter from the storms and cold. This is particularly true of birds that migrate, as only about one fourth of those that leave us ever return.

LESSON V

BUILDING MATERIALS — BRICK

Let the class visit a brick building in course of erection. Of what are bricks made? What is the size of a common brick? How is it laid? Why are the joints broken in the wall? What ratio is the width of a brick to its length? Of what value is this? Describe the mortar used in laying brick. Of what is it made? What good does it do in a wall? How do the workmen keep the walls vertical? How thick is the wall of a one-story house? two-story, etc.?

Visit a brickkiln and study the various processes in making bricks. What is the proportion of sand to clay in a brick? How are bricks colored? Why are they burnt? What effect has heat upon clay? How are bricks sold? What do they cost?

If convenient, let pupils make some adobes or sun-dried bricks, and construct a small brick house.

LESSON VI

BUILDING MATERIALS — STONES

Mention all the materials you can think of that are used in building a house. Tell for what part each kind is used. Why is stone generally used for the foundation? What kind of stone is used most commonly for this purpose? Where is it obtained? What does it cost? Mention other kinds of stone used in building. Discuss the properties, uses, source of supply, and cost of limestone, granite, marble, onyx, and other kinds of stone used in buildings. Note their hardness, cleavage, color, beauty, and adaptability to their respective uses, and account for the frequent or rare use of kinds discussed. Use samples of each kind discussed in the class.

Visit a quarry, or stone works, and study the processes of preparing stones for use, — splitting, sawing, cutting, carving, polishing, etc., and the machinery used for these various processes.

Let the pupils bring samples of building stones and pebbles, and test them for hardness, cleavage, polish, etc. Teach the children to recognize and name all kinds of useful stones found near the school.

LESSON VII

SAND AND CLAY

Compare pulverized clay and sand. Note their colors. Let a box of both stand an hour in the sunshine, then test their temperatures. Pour a little water upon each. Why does it so quickly disappear in the sand and not in the clay? Clay is impervious to water. Which, then, absorbs more water? Examine both with a lens, and note difference in texture.

Note how plastic the wet clay is, and how easily it can be molded into any desired shape, while the sand will scarcely cohere at all, and can be used only for modeling maps, etc., in school. Describe a clay formation; a sand bed. Let the pupils visit each, if practicable.

Bake a sample of each, and discuss the many uses of clay in the arts, by both primitive and civilized man.

LESSON VIII

THE STORE—SOURCE OF HOME SUPPLIES

Name several kinds of stores that you know about. Where do we get our clothing? From what kind of store do we get our shoes? What do we get from the grocery store? the meat market? the greengrocer's? Where do we buy our medicines? our jewelry? What house supplies do we get from a hardware store? Which of all these stores is the most important? Which furnishes us with less important things? What should we do if there were no stores?

In olden times, when there were few stores, people had

to raise most of their own food and make their own clothing, and get along without many things we now enjoy. Many of us have luxuries now which kings and queens did not enjoy a century ago.

On what conditions do we get things from the store? How do people get money now to buy so many things? Develop in a simple way the advantages of division in labor, showing how much better it is for a man to work at one thing and get money enough to buy many things, than it is for him to try to raise and make everything himself that his family needs. In olden times there was but little money, and so the people could not buy so many things.

LESSON IX

SOURCES OF SUPPLIES FOR THE STORE

Does the merchant raise or make what he sells? Where do most of the grocer's supplies come from? Where, for example, does he get his flour? grain? potatoes? fruit? vegetables? cheese? vinegar, etc.? On what condition does he get these things from the farmer or producer? Does he sell them to us for the same price that he pays the farmer? Why not? Why are we willing to pay the storekeeper more than he pays the farmer for the things we buy of him?

Does the farmer sell all that he raises? Why does he sell only the surplus? What, then, does the farmer have to buy? How does he get the money to buy these things with?

The pupils should visit a store and notice the kinds of goods sold. They should learn where the goods come from, and how the storekeeper gets them. They will soon

understand that commerce is a means for the interchange of useful products, and that the profits of the merchants usually are just and reasonable.

The play store already described may serve a very useful purpose in all the lower grades. It may be conducted by the pupils in each grade, in turn, to suit the convenience of the work.

LESSON X

CHANGES IN TEMPERATURE

What part of the day is coldest? What part is warmest? Why is it warmer near noon than in the morning or evening? Use a shadow-stick, and note the length of its shadow in the morning, at noon, and at night.

Light and heat come together to us from the sun. When the shadow is long, the heat contained in the sunbeam obstructed by the upright would fall on how much space if the upright were removed? At noon, when the shadow is short, the heat from a like beam would fall on how much space if the upright were removed? Account, then, for the greater heat at noon.

Give other illustrations of the greater heat in direct than in slanting rays. Which is stronger, a direct or a slanting blow? When reading in a dim light, how do we hold our book to see best? Why? What part of an object standing near a fire gets hot first? Why? On which side of the schoolhouse do the boys congregate on a cold day? How do the sun's rays strike this side? How do they strike the other sides?

What change of temperature occurs as we ascend a mountain? Where does the snow melt first, in the valley or on the

mountain? Where can snow be found all summer, even in warm countries? Why? People who ascend high in balloons take warm clothing with them. The temperature of the City of Mexico seldom exceeds 70 degrees, while in many places much farther from the equator it reaches 100 degrees, or higher. Why is this?

LESSON XI

THE THERMOMETER

Show the pupils a thermometer. Breathe on the bulb, and let them see the mercury rise. Hang the thermometer in a warm place, and note the change in the height of the mercury. What makes it rise? What makes it fall? Of what use, then, is the thermometer?

Let the pupils note the grading of the thermometer. Some excellent number work may be done in recording and comparing temperature changes. At the proper time, take the temperature of melting ice or snow and also that of boiling water, if the instrument is made to indicate boiling point.

Teach the children to judge the temperature of the air, verifying by looking at the thermometer. Let them feel of, and judge, the temperature of very warm water. Test with a thermometer. Reduce the temperature 20 degrees by adding cold water. Let the pupils feel of it again and judge its temperature, then verify by using the thermometer. Add more cold water, and test as before.

In a subsequent lesson the same work may be done, lowering the temperature 10 degrees each time instead of 20 degrees, letting the pupils judge each time, and after-

fying by the thermometer, until their temperature omes more accurate. In a similar way begin water and change its temperature by adding hot g the pupils judge each time.

ıry use the thermometer should be hung where the average temperature of the air out of doors, and should be read each day one or more times by the pupils at regular hours, and the temperature recorded or expressed graphically upon the blackboard, so that the gradual changes may be noticed as the seasons advance.

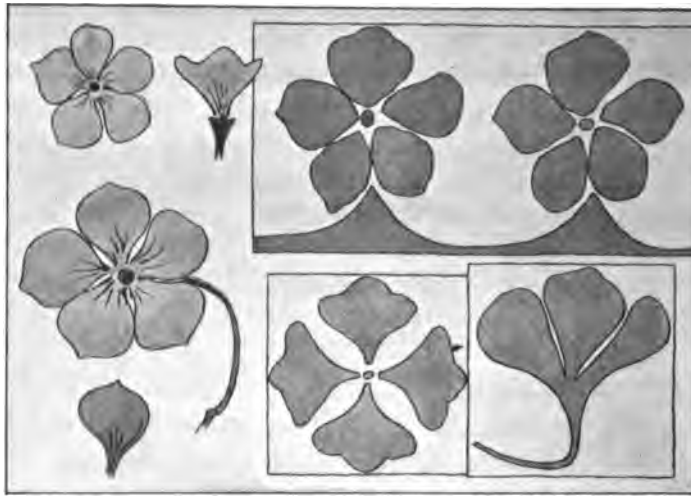
LESSON XII

GENERAL STUDY OF TREES

Ask each pupil to select four or five trees and shrubs near his home or the school, to study during the entire year. Occasionally spend a recitation period in calling for reports of changes observed. The teacher should set herself the same task; she will learn as much, perhaps, as her pupils. The trees selected should be different in their habits of growth; *e.g.* a cottonwood, chestnut, locust, a fruit tree, an evergreen, a wild shrub, and a climbing vine.

The following are some of the points that should be observed: difference in shape, masses of foliage, relation of trunk and branches, any changes in color, development of fruit or seed, the season's growth, the falling of the leaves, formation and protection of buds, winter appearances, bursting of buds, location of largest buds, dormant buds, periods of greatest growth, influence of the weather, etc.

As a language lesson, the pupils may write a description of the trees being studied. As a lesson in art, they may



FROM NATURE STUDY TO ART

paint or draw one or more of them. In fact, a series of drawings — one for each month — will make a beautiful and truthful record of their year's work on trees.

LESSON XIII

SHADE TREES

Of what use are shade trees? Mention in their order of excellence as many as you can. The teacher should make a list of all kinds given. Describe each kind. Compare the trunks, branches, leaves, growth, etc. Which are troubled with ants, bugs, and other insects? Which are freest from such pests? Examine and compare twigs, leaves, bark, etc., in the class. How and where are shade trees planted? What kinds are planted wide apart? Which kinds are planted near each other? Account for this differ-

ence in distance. How are they supplied with water? How should they be kept trimmed? What annoyance occurs if the lower limbs are allowed to grow? If trees grow too high, what fate sometimes befalls them?

The pupils should learn to recognize the twigs and leaves of as many kinds of shade trees as the teacher can procure.

LESSON XIV

FRUIT TREES

Which trees are the most useful to man? Name all the fruit trees with which you are acquainted. Make a list upon the blackboard. Take the class to visit a near-by orchard. Learn to recognize the different kinds of fruit trees and different varieties of each kind. Note the leaves, — their shape, color, number, arrangement, etc.; the branches, bark, trunk, etc., and the peculiarities of each. See if any insects are preying upon any of them or their fruit.

Make a list of fifty trees for a family orchard. Give reason for kinds chosen. Which would require to be planted widest apart? Which require less space? Apple trees need to be planted about twenty-five feet apart, while pears and plums will do well a rod apart. What determines this distance?

Which fruits come early? Which come late? Which will keep all winter? Discuss varieties of apples; of pears; of cherries, etc., from samples.

How are trees raised? Visit a nursery, if possible, and let the pupils see how the seeds, or pits, are planted close together in long rows. When they sprout and begin to grow, they are usually "budded" in August of the second

year. When the new bud begins to grow, the main trunk is cut off so that the strength of the root will go to the bud,

ORCHARD — UTAH NORMAL TRAINING SCHOOL

making it become the main stem. The next year it is generally transplanted.

If possible, plant some seeds, or pits, and let the pupils care for them; bud and transplant them into gardens at home.

LESSON XV

TROPICAL TREES

With the aid of pictures and samples of tropical fruits, the teacher should give the class an idea of the remarkable and useful fruits from the tropics. The samples obtained may determine what ones are treated. The orange, lemon, banana, and cocoanut are perhaps the most common; though the pineapple, mango, breadfruit, and others are equally interesting.

A good geography, book of travels, or an encyclopedia will contain information for a few lessons on this topic, which will greatly interest the pupils of this grade.

LESSON XVI

EFFECTS OF FROST UPON PLANTS

Note the first frosts and their effects upon plants. What plants are "frost-bitten" first? What effect has frost upon these plants? Are all plants affected by it in the same way? The ones most easily injured by frost may be called *tender* plants; those not so easily injured by it we call *hardy* plants. Mention several tender plants; several hardy plants. How may tender plants be protected for a time against the frosts? What plants are killed by the frost before their fruit all gets ripe? What great harm is sometimes done by frosts that come too early in the fall? What harm is often done by frosts that come too late in the spring? Does frost do any good to anything? Why do we need frost? Notice each morning whether there is frost or dew on the grass and other plants.

SECOND GRADE — WINTER WORK

LESSON XVII

PREPARATION FOR WINTER — MAN

What changes in our homes are made necessary by the change in temperature now going on? Let the pupils suggest the things usually done in the fall before it snows: *e.g.* raking up the fallen leaves and burning them; removing

the wire screens from the doors and windows; setting up the heating stoves; cleaning the furnace; coiling up and putting away the lawn hose; storing fruits and vegetables, for winter use; closing cellar windows to prevent the frost from entering; buying the winter's coal and kindling, etc. In a rural school many other activities may be mentioned, as fall plowing, repairing barns, stables, henhouses; the care of fruit crop and vegetables, etc.

What changes do we make in our clothing? Compare cotton, woolen, and silk goods as to their warmth. Why are light colors worn in summer and dark ones in winter? What changes are made in our bedding?

What tradesmen are very busy now who will have little to do at their trade in winter? What tradesmen have more work on account of winter? What games do we play in the fall?

LESSON XVIII

PREPARATION FOR WINTER — ANIMALS, INSECTS, AND BIRDS

Lead the pupils to notice which animals and birds are present now and which ones are missing. A record of those seen, kept on the blackboard, will stimulate observation. Discuss the reasons for their disappearance, — the two chief ones, perhaps, being the weather and the food supply. Some birds, as robins, are so nearly omnivorous as to be able to stay with us most of the year, while some of our canaries and other songsters are so particular in their food that they seek only the larvæ of certain insects, and can remain with us only the few days that this food lasts.

As winter approaches, fruits, grains, insects, and tender

vegetation become more scarce, and the birds go south where their food can be found. Help the pupils to develop this thought from what they have noticed. Do birds of prey migrate?

The absence of the butterfly may be explained in a similar way. Its food is gone, and it is poorly adapted to stand cold, stormy weather. Can it travel well? Will it follow the birds? Hunt cocoons and keep them till spring. Also account for the disappearance of the frog, lizard, house fly, mosquito, snakes, etc.

Occasionally a caterpillar may be found and placed where the children can see it make its cocoon.

Note where typical kinds of animals go, and how they spend the winter, and why. Discuss their intelligence, ability to travel, and physical structure, and bring out how they are adapted to their respective methods of passing the winter.

LESSON XIX

PREPARATION FOR WINTER — PLANTS

A field lesson, where pupils can examine the conditions of both wild and cultivated plants, should form the basis of this work. Many changes, made necessary by winter conditions, can be discovered, and their relations traced. The following are a few that the children may be led to see: — The leaves have fallen from most shrubs and trees. Why? New buds are formed near the old leaf scar. What for? Some buds are covered with scales, some with fuzz, and some with gum. Why are they thus protected? Measure the growth the twigs have made this year. How can you tell? What trees are rapid growers? Which grow more

slowly? Do trees and shrubs bear seeds? What has become of them? Will the cold of winter kill them?

What plants have died? Have they borne seeds? What has become of the seeds? Will there be similar plants next year? How are the seeds distributed?

Are any plants found whose tops are dead, but whose roots will live over the winter? Have they borne seeds? Plants that live from year to year, like trees and shrubs, are called *perennials*. Those that live but one year are called *annuals*. Those that live two years, developing their seeds the second year, are called *biennials*. Mention plants of each class.

Experiment. — Bring a small panful of earth to the schoolroom; keep it warm and moist and see if any self-planted seeds will grow, and how many.

LESSON XX

DECIDUOUS AND EVERGREEN TREES

Mention trees which shed their leaves in the fall. Make a list of them. Do any trees retain their leaves all winter? Name all such trees that you know. Which of the deciduous trees are tall and slim? Which of them are broad and spreading? What is the general shape of the evergreen trees? Draw a pine, a cedar, a fir, etc.; an apple, a locust, an elm, etc., to illustrate for the pupils the general character of growth and shape; or, better still, take the pupils out where they can see these differences.

What is the size, compared with the trunk, of the branches of most deciduous trees? Where do they leave the main trunk? At what angle do they leave it? Compare the branches of the evergreen tree in the same particulars.

What would be the effect if the leaves should remain on deciduous trees till heavy snowstorms come? How do the evergreens contrive to get rid of the loads of snow that fall upon them?

Bring out the fact that the evergreen branches are nearly at right angles to the trunk, so that they will not have to bend downward so far to cause the snow to slide off; that they are short near the top of the tree and get large by degrees toward the bottom, and form successive umbrella-like layers so arranged around the trunk that the snow falls only on the tips of the branches, which most easily bend. The leaves, too, are small and needle-shaped, and not adapted, like the deciduous leaves, to catch loads of snow.

Break a twig of each, and prove before the class how much tougher is the evergreen twig; the snow cannot break it. The acute angle of the poplar twig, for example, causes it to bend almost double if loaded with snow, and, being brittle, it is almost sure to break.

An untimely snowstorm, a few years ago, so stripped seventy-five Lombardy poplar trees in a certain locality, that they resembled telephone poles the next day.

LESSON XXI

A SNOWSTORM

When weather conditions indicate an approaching snowstorm, have the pupils make a special study of the conditions. Which way does the wind blow? What kind of clouds are most abundant? What is the temperature? Note also the height of the barometer, if there is one in

school. Watch the changes in any of these conditions. Usually a south wind, changing to the northwest, will be followed by a storm in the inter-mountain region. In other localities indications of storms are somewhat fixed or regular. Set out a rain gauge, or other vessel, to catch and measure the precipitation.

Let the pupils watch the falling snowflakes, and examine them with lenses. Call attention to the needle-like crystals of which they are composed. Compare them with the first crystals of ice that form on the surface of freezing water.

Discuss other forms of precipitation, — rain and hail. Under what conditions do they form? Where does the snow usually fall more heavily, in the mountains or the valleys? Why? Discuss the benefits of a heavy snowfall in the mountains, in the arid regions, and its influence upon irrigation, and consequent value to the farmer.

Do the snows that fall in the mountains in the winter affect in any way the farmers in the great river basins? What causes high waters in the spring? What conditions bring about floods in the river basins? How may floods be predicted? Can man influence floods in any degree? How?

Consider, also, the influence of summer rains, in various regions.

After the storm, melt the snow that fell in the rain gauge and determine how many inches of snow it takes to make one inch of water.

Since the heaviest precipitations in the arid regions of the United States occur nearest the high mountains, the level lands are mostly deserts, and the largest cities and farms are among the mountains.

LESSON XXII

WINTER DWELLERS

Take the pupils to visit a good stable or barn in which horses and cows are kept. Note the provisions made to keep them warm, and to protect them from the cold winds and storms. A careful driver will blanket his horse in winter when he halts for a time, so the animal will not get chilled and take cold. The barnyard fowls, too, should be properly provided with shelter, as well as the pig, the dog, and other domestic animals.

Out west on the range, unprotected by a suitable shelter, many of these animals perish in winter, and nearly all of them become very poor, if not sick. Why do these animals generally go in herds or large numbers? Tell of some of their difficulties in obtaining food and water, as well as shelter in winter. Often they eat snow for water, and paw away the snow to get at the grass underneath. When the snows in the mountains become too deep for them, the herd migrates to the valleys.

Some animals gnaw the bark off live trees for food; and very often the early pioneers had to cut down trees and allow their horses and cattle to eat the small and tender twigs to keep them from starving in the winter time.

Discuss the wild winter dwellers, especially the fur-bearing animals: the beaver, marten, lynx, bear, wolf, coyote, etc. How do they get their food? How are they protected from the cold? Study one or two in detail with the aid of stuffed specimens or good pictures, and thus illustrate the lives of the others.

Make a dog kennel; a bird house, etc.

LESSON XXIII

SHELTERS FOR WINTER DWELLERS

Mention all the natural shelters you can think of sought by wild animals that remain during the winter. Which animals take shelter in caves and underneath overhanging rocks? Do any live in hollow trees? Which burrow under the bark of trees? Cracks and crevices form a winter shelter for what animals?

What animals burrow in the ground and live there during the cold weather? Discuss the gopher, the prairie dog, the ground squirrel, etc., and their winter homes. Why is the ground owl so called? How deep do such animals have to dig to get below the frost in the ground?

What can you say of snow as a protection from the cold? Snowbirds often bury themselves at night in the snow. Eskimos' houses are made of snow and ice. Travelers and mountaineers often find a covering of snow a secure protection from freezing to death. Snow is useful also to the farmer in keeping the fall grain from freezing.

How does the beaver protect himself at once from cold and other enemies in the home he builds? What can you say of the winter home of the sparrow? What birds seek the shelter of the dense foliage of the pine and other evergreens? Does the rabbit provide for himself any protection except his fur?

Describe the winter home of the mud-wasp. Do any insects remain alive all winter in their fully developed state? Where do they hide till spring? What animals will you find in early spring under stones or boards that have lain all

winter on the ground? Describe winter conditions in the bee hive and the ant bed?

How does civilization interfere with the winter homes of wild animals? How does it interfere with the summer shelter of birds and other useful animals?

LESSON XXIV

SPECIAL STUDY OF WOOL

What useful articles are made of wool? In what season are most woolen goods used? Where do we get the wool? Can you name different kinds of sheep? For what other purpose are sheep used? Which kinds are best for mutton? What breed is good for both? The Merino produces long, fine wool, the Southdown is more valuable for mutton than for wool, and the Shropshire is valuable for both products. Pupils should study pictures of different kinds of sheep. Visit the State Fair and study the breeds of sheep usually seen there.

What food does the sheep eat? Why is it so profitable to raise sheep? Discuss the care of sheep, and the life of the shepherd.

How is the wool obtained? Show the pupils a pair of sheep shears, and describe how the sheep are sheared. In what month are the sheep sheared? Why? What harm often comes to a herd of sheep that has been sheared too early? Where is the shearing generally done? How much wool comes from a sheep? What is done with the fleece? What is wool in the fleece worth per pound? Tell how it is put into great sacks and shipped to large factories, where it is manufactured into cloth and other useful articles.

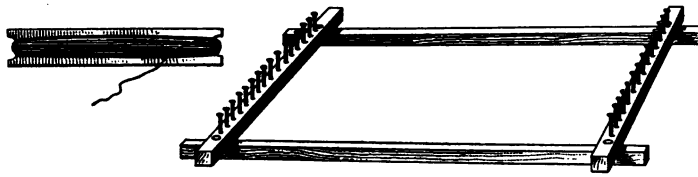
Experiment. — Try to twist a few hairs into a thread; twist a few fibers of wool into a thread; note the difference in results. Examine hair and wool with a microscope, and account for the above results from the difference in structure.

LESSON XXV

THE MANUFACTURE OF WOOL

Bring some wool to school, and let the pupils take part in as many of the processes of manufacture as possible.

What is the first thing to do with the wool? The pupils may wash the samples, and the teacher explain how large



A Shuttle and Simple Loom

quantities are washed in great kettles heated by steam. It is then dried, most of the water being driven off by whirling it rapidly in a machine made for that purpose.

When the wool is dry, what is usually the next process? How is wool dyed? If convenient, a small sample may be colored with prepared dyes, though vegetable dyes, collected by the pupils, would be better.

How may the matted masses of wool be broken up so as to be spun? Describe a wool-picking machine, and show how it tears the wool into a fine, feathery condition. Were it possible, the children should visit a woolen mill and see the machinery at work. At least, pictures of the processes should be used.

What is needed before the fibers of the wool can be spun into a thread we call yarn? With a pair of hand cards show how the fibers are combed into a roll, all running in the same direction. By twisting this roll the fibers are brought close to each other in such a way that they cling together and form a strong yarn. The pupils may twist some of the rolls from the hand cards into coarse yarn.

WEAVING — SECOND GRADE PUPILS

Next describe the process of weaving. Show how threads running parallel are crossed by others running at right angles in such a way as to form a fabric. The pupils can make a simple loom and do some weaving.

NOTE. — It may require several lessons to complete this work. In a similar manner feathers, furs, hair, and other animal coverings may be studied in detail.

LESSON XXVI

ANIMAL MOVEMENTS

What birds fly fastest? Make a list of them. What birds fly slowly and awkwardly? Make a list of these, also. Compare the relative length of their wings and the weight of their bodies. Why do the first class need to fly rapidly? What is their food? How do they get it? Do any of them seize their food while on the wing? What are their enemies? How do they escape or protect themselves from their enemies? What aid is a rapid flight in these activities?

Discuss the birds of slow flight in a similar way. Show a less need in them of the power of rapid flight.

Which birds run? Which hop? Which swim?

Describe the movements of the cat, dog, rabbit, squirrel, hen, duck, goose, turkey, sparrow, and of other well-known animals and birds, when getting their food or defending themselves, or escaping from their enemies. Note also the shape and size and strength of their limbs, teeth, beak, claws, etc., and how used in food-getting and defense. Let their adaptation be discovered by the pupils. Use pictures and stories of animals as well as familiar live specimens for illustration.

If the school has an aquarium, the movements of fishes and other animals in the water may be observed and discussed. The crawling of the snake and of various kinds of worms should be noted also, as opportunities to observe them occur. The children should describe and imitate the various movements observed.

Several lessons may be devoted to this work.

LESSON XXVII

ANIMAL LANGUAGE

Do you ne'er think what wondrous beings these?
Do you ne'er think who made them, and who taught
The dialect they speak, where melodies
Alone are the interpreters of thought?
Sweeter than instrument of man e'er caught?
Whose habitations in the tree-tops even
Are halfway houses on the road to heaven?

Think, every morning when the sun peeps through
The dim, leaf-latticed windows of the grove,
How jubilant the happy birds renew
Their old melodious madrigals of love!
And when you think of this, remember too
'Tis always morning somewhere, and above
The awakening continents from shore to shore,
Somewhere the birds are singing evermore.

— LONGFELLOW.

Describe the singing and chirping of different birds: the blackbird, robin, meadow lark, oriole, crow, canary, etc. What time of the year do they sing most? least? Why? Discuss the calls to mates, the cry of alarm, the chuckle of satisfaction, the scream of terror, as well as the song of joy, and the service of these sounds to the birds using them.

In like manner discuss the bark of the dog, the neigh of the horse, the howl of the wolf, the bellowing of the cow, the bleat of the lamb, and other sounds made by animals. Note the circumstances under which they are made, the object of making them, the intelligence manifested, etc.

Do animals talk or communicate thoughts? Tell stories and anecdotes to illustrate this. Encourage observation and the recital of personal experiences in this connection.

LESSON XXVIII

FOREST TREES

What plants grow in communities? What plants grow solitary? What plants need the most room? Which ones can do with less room? What is the difference in their shape? in their trunks or stems? What trees spread over much space? What trees are tall and straight and take up little space? What part of a tree is sawed into lumber? Which of these two kinds of trees would make the best lumber? Show pictures of great lumber forests.

Name the principal trees used in making lumber. How do they grow? The teacher may bring out the facts that lumber trees are tall and straight; that they have small branches, high up the trunk, leaving a long portion of the trunk free from knots and adapted for sawing into boards. They grow close together, making it convenient to erect mills where much lumber can be obtained within a short distance.

Contrast this with the trunks of the widespreading trees, which divide too low down to admit of sawing long boards from them. Generally such trees do not grow in dense forests, but are scattered.

LESSON XXIX

LUMBERING

Secure a piece of a small tree or limb, about two feet long, and four or five inches in diameter. If it has one or two knots, it will be all the better. Let this represent a log of wood cut to be sawed into lumber.

Discuss and illustrate with pictures how the great trees

are cut down, and then cut into logs of a convenient length and dragged over the snow to the edge of a river, where, in the spring, they will float down to the sawmills below. Each log is so marked that if more than one mill is on the river, the workmen at each will take only those logs belonging to it. The logs are placed on a sliding framework which moves past a saw or set of saws, carrying the logs with it. The saws cut each log into boards of the required thickness.

Cut the sample piece of a tree or limb lengthwise into strips resembling boards. If a small circular saw can be used for this, it will be better, but a handsaw will do. Show the class how the first and last boards will be slabs and the edges of all will be irregular, and have to be trimmed afterward. Show how a limb causes a knot, and many knots will spoil the lumber. Study, also, the grain and how knots influence it; also how the relation of the surface of the board to the heart of the tree affects the grain.

LESSON XXX

SIMPLE PROPERTIES OF WOOD

Show the pupils samples of oak, pine, poplar, maple, birch, walnut, and other kinds of lumber. Have the pupils note the grains and textures so that they can easily recognize each of the common kinds at sight. If convenient, teach them in like manner some of the more costly woods, as mahogany, rosewood, cherry, ebony, etc., used in cabinet work and musical instruments.

From the branch of a tree, cut cross sections, diagonal sections, and longitudinal pieces to illustrate the grain, which often makes wood so beautiful.

Small samples of different kinds of wood may be prepared of uniform size and shape, planed; the lower half may be finished in oil, or varnished to show the different kinds of wood, and the effect produced by oil, stains, varnish, etc. These samples, placed on a card or thin board, will form a very useful piece of apparatus.

Test the hardness, strength, and weight of different kinds of wood, and suggest suitable kinds for various uses. What kind is used for floors? doors? shingles? chairs? wagon tongues? whipstocks? carriage spokes? Tell why each is suitable for the use assigned. Mention woods that are tough; others that are hard; others that are soft, etc. Test in various ways these properties in samples of wood that may be obtained.

SECOND GRADE.—SPRING WORK

LESSON XXXI

USES OF WOOD

Where is wood obtained? Mention some uses of wood. What parts of a house are made of wood? What furniture is made of wood? What useful implements are made largely of wood?

Where is wood used for fuel? Why? Mention useful articles made from wood. How is charcoal made? For what is it used? Where is our chief supply of wood and lumber obtained?

Do new trees grow as fast as the old ones are being cut down? The supply is gradually growing less. What care should be taken of our forests? Forest fires often destroy

many acres of our forest trees. How are they often started? Sheep will gnaw and eat the bark from the stems of young trees and kill them. In what other ways may forests be injured by means of carelessness or ignorance?

The government is trying to get the people to plant small forest trees on all waste lands so that we shall not run out of wood. Many of our forests are now protected by the government to prevent their destruction by fire, large herds of animals, or by waste of any kind. Such areas are called Forest Reserves or National Forests, and officers continually guard them.

How long does it take for a tree to grow until it is big enough for lumber? How can you tell? Count the rings or the grain in a board, and form an estimate. Already the kind of cedar used in making lead pencils is nearly gone and the manufacturers hardly know what they are going to do. Substitutes for wood are being used in many places. Pencils are covered with paper. Wharves and piers which require great quantities of lumber are now being made of asphaltum, and bridges and supports in buildings, formerly made of heavy timbers, are now made of cement.

LESSON XXXII

THE SENSE OF SIGHT

What light rules the day? What light rules the night? When can we see better? Why? What do we do to aid our sight at night? We see things because light from them comes into our eyes. The little black spot in our eyes is a sort of window which lets in the light. You can see it grow large or small as you remove the light or bring it close to another's eye. It is a self-regulating window.

What happens if too much light enters the eye? Why do we have to use a smoked glass to look at the sun? What happens when little or no light enters the eye? Consider the disadvantages of the blind. Why can an owl or a horse or a cat see at night better than we can? This window can be made larger to admit more light from objects. Why are the fishes and crawfishes in the Mammoth Cave blind? If they had eyes, of what use would they be?

Look at a cat's eyes. Notice how long and narrow the pupil is: when it opens at night or in the dark, it is much larger than the pupil of a person's eye.

What care should be taken of the eyes?

LESSON XXXIII

EVAPORATION

What becomes of the water when the teakettle boils dry? when wet clothes are hung out on the line to dry? Does all the rain after a shower soak into the ground? Refer to many familiar examples of water disappearing in this way. Perform a few simple experiments to illustrate evaporation.

Do other liquids evaporate? Show by experiment that alcohol, turpentine, gasoline, ammonia, chloroform, and many other liquids pass readily into vapor, and that glycerine, olive oil, pitch, tar, and perhaps other liquids evaporate very slowly, if at all. Note that the rate of evaporation differs greatly for different liquids.

What is steam? What are clouds? How are they made? Mention many ways in which evaporation is a blessing. What will hasten evaporation? How can we hinder or prevent evaporation? Give illustration.

LESSON XXXIV

WEATHER CHANGES

What did Jack Frost do last winter? What traces has he left behind him? What did he do to the soil? to plants? to seeds? Is the ground as hard to plow now as it was in the fall? Has he injured man in any way? Has he aided man in any way? Notice if the trees, fruit buds, fall grain, or stored vegetables were injured by frost.

What has driven Jack Frost away? Compare the average weekly temperature for the past month; also the length of the shadow on the shadow-stick. Find the change in the sun's path, and account in a general way for the change in temperature.

When it storms now, does it rain or snow? Do you notice any effect of the weather upon plant life? Are any seeds germinating? Have any flowers bloomed? When do the butterflies appear? Watch for the return of the birds. Which appear first? What influence has the change in the weather upon man and his work?

LESSON XXXV

KINDS OF PRECIPITATION

How can we tell when a storm is approaching? Discuss the winds, the clouds, the temperature, and other meteorological conditions. What kind of clouds always cover the sky when it storms? What determines whether the precipitation will be rain or snow? Under what condition is hail formed?

When does sleet occur? At opportune times study with care each form of precipitation.

Discuss in turn the good that comes to man from rain and snow. Compare the rainfall on arid regions with that of more humid places, and the results to vegetation and crops. Mention also damage done by floods caused by too much rainfall. Also tell how hailstorms are at times so violent as to destroy crops, kill animals, and do other damage.

LESSON XXXVI

THE SEASONS

Name the four seasons. Describe each. Tell some of the effects that each has upon man; upon animals; upon plants. What games do boys play in the spring? in summer? in autumn? in winter? Which season do you enjoy most? Which two are nearest alike in weather and temperature? Which are the opposite of each other? Where is the sun at noon in the summer time? Where is it at noon in the winter time? What is the effect of this difference in position? What month has the longest days? What month has the shortest days? How do these months compare in temperature?

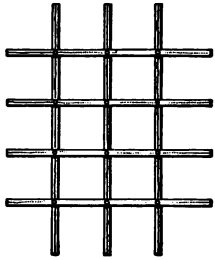
Describe the daily motion of the sun. What part of the day is generally coldest? Why? What part is warmest? Why? How does the sun influence these changes? Describe the sun's annual motion. What is the effect of this motion upon the heat we get from the sun during the year? When the sun is above us, how is it situated for people far south of us? When the sun visits and warms us, it leaves them cold. When it goes south and shines directly on them, it leaves us cold.

LESSON XXXVII

GERMINATION

Several weeks before it is time to prepare a school garden some work in germination may be done in the schoolroom.

Experiments. — Make meshes 2 × 2 inches with sticks tacked together crosswise, and place them in a sand pan or other shallow vessel. Cover the meshes with cotton batting,



GERMINATION PAN

and keep them wet. Let each pupil be assigned a mesh, or "little garden," which he fills with a variety of seeds. Large seeds, such as corn, bean, squash seeds, etc., are preferable, but the variety should be great. Place the germination pan in a warm place, and have the pupils watch the stages of germination and plant growth.

If it is not convenient to get the germination pan, a small piece of mosquito netting may be tied loosely over a tumbler full of water and filled with seeds, which may be watched while they sprout. A sponge filled with wheat and kept moist will prove an interesting experiment. Any vessel filled with sawdust will also serve for this work. Some seeds may be planted in soil and allowed to grow without being handled by the pupils.

Application. — At proper times the teacher may call attention to the successive steps in germination, viz. the swelling of the seed; the bursting of the seed cover; the appearance of the stem, of the root; the direction of each; the shrinking of the seed as growth proceeds, etc.; and the reasons for each of the changes.

The taste of many seeds changes as the process of germination develops. Let the pupils discover this fact.

LESSON XXXVIII

BUDS

See if the sap has begun to flow. Let the pupils make willow whistles. Note the conditions of the buds, — how they have been protected during the winter. Distinguish between fruit buds and leaf buds before they burst, and note the changes in the buds as soon as the sap begins to flow. See if the pupils can tell which buds will burst first and which will not burst at all. What determines active and dormant buds? What is their relative position on the tree? What is the office of dormant buds?

Experiment. — After the active buds on a given twig have all begun to grow, and all doubt is past as to which are dormant buds, destroy all the active buds and let the pupils discover the use of the others.

Application. — Should the late frosts kill all the active buds just after they had burst, to what extent would the tree be injured? Notice the unfolding of the buds. Do leaf buds or fruit buds unfold first? Can you give any reason for this? Have you ever seen an orchard in bloom? How beautiful the blossoms are, unhidden by the foliage! Note

also the positions of the blossoms, whether on the outer or inner twigs, and account for this. Note what becomes of the blossoms, and what follows them. As the season advances, measure the rate of the growth of twigs.

Do twigs bearing fruit grow as rapidly as those on the same tree bearing no fruit? Explain. Do twigs grow in length only at the ends? Measure the internodes at intervals of a week or so, and find out.

LESSON XXXIX

THE CHEMISTRY OF GERMINATION

Experiment 1. — Put a small quantity of salt, of sugar, of sand, of starch, and of flour into separate test tubes. Add a little water to each, and shake vigorously. Which dissolve? Which simply mix? What is the difference between dissolving and mixing? Which, then, will not dissolve in water?

Experiment 2. — Add a drop of tincture of iodine to the starch, and note the dark purple color produced. Add in the same way a drop to each of the solutions, and note which will turn purple and which will not. This is a simple test for starch. Mash wheat, corn, beans, and various food seeds; also potato, beet, etc., and add to each a little water in a test tube, and test as above. Starch may be detected in this way in a great many articles of food.

Experiment 3. — Let pupils taste seeds they have been watching germinate. Does the taste of the seeds change when they begin to grow? In what way? What do you think makes them sweet? Of what is sugar made in the sugar factory? Is there any starch in beets? The teacher may tell pupils that starch may be changed to sugar, and

call attention to other chemical changes equally surprising, *e.g.* cider to vinegar, lye and grease to soap, etc.

Application of Experiments. — What is the object of the mother plant in storing up starch in the seed? What change occurs in the size of the seed as it grows? Do any animals provide food to sustain their young until the latter are big enough to procure food for themselves? Mention may be made of the large fish egg that floats about with the young fish until it is all absorbed, by which time the fish is large enough to hunt its food; of the mud-wasp sealing up near the young larvæ food for the latter when it comes to life in the spring; of the ostrich and many other animals, which provide food for their offspring which they may never see. If, then, this starch is stored food for the baby plant, how does it reach the stem and leaves to make them grow? We learned in the first experiment that starch will not dissolve in water; so how can the water take it up? What will dissolve in water? Why do you think the seed changes to sugar? What becomes of the water after it has taken the sugar food up into the stem and leaves?

Experiment 4. — Invert an ordinary fruit jar over a potted plant in a sunny window, and let pupils see the drops of moisture which collect inside the jar.

Why would it not be wise for the parent plant to fill the seed with food in the form of sugar instead of starch?

LESSON XL

FLOWERING PLANTS

What plants bear flowers? Make a list of wild flowers that you know. Make a list of the cultivated flowers that you know.

From samples and colored pictures, etc., teach the pupils to recognize many flowers, both cultivated and wild. While they study, let them also enjoy the flowers, and make wreaths, bouquets, etc. Incidentally they may learn the names of some of the parts, as petals, sepals, leaves, etc.

Exercises in the study of color and formation are given easily with flowers. What are the most common colors in flowers? Select all the white ones; all the yellow; all the red; all the purple, etc. Arrange these according to their tints, placing the dark ones on one side and the lighter tints on the other side, ending with the lightest. Which are the largest flowers? Which the smallest? Put together flowers that seem to have the same shape or arrangement of parts.

A WILD FLOWER HERBARIUM

This book was filled with specimens gathered and pressed by first grade pupils of the Utah State Normal Training School. Most of them were found near the school. The common name is written under each, and the pupils learn when and where they bloom.

Which flowers grow in or near the water? Which are found in dry, hot places? Which grow in shady, cool places? Which bloom earliest? Which are the late bloomers? Why do they not all bloom at the same time? Would you like to have them do so?

Make a collection of flowers, and arrange the samples in the order of their blooming. Record the name of each and the date and place where it was found.

LESSON XLI

NON-FLOWERING PLANTS

What trees and plants never bloom? What small plants never have flowers? Of what use are such trees? Do we admire any plants that never bloom? What kind of home do moss and ferns like? Do flags and bulrushes bear flowers? Does water cress? Some plants bear flowers that have no beautiful petals, and we think they are not flowers. Hunt for flowers on grasses, wheat, sagebrush, pine trees, other evergreens, etc.

What takes the place of the flower when it wilts and drops off? Do non-flowering plants bear seeds? All these conclusions should come from the observation of samples, and should not be guesses.

LESSON XLII

THE SCHOOL GARDEN

As far as applicable, do the work in this grade that is given in the outlines for the first grade. More and better work should be accomplished. A few simple experiments in planting seeds may be done in this grade, and the children may watch for results.[1]

If an interest is created in the work, new problems will arise constantly while the pupils are digging, raking, sowing seeds, watering, weeding, etc., and they will acquire a vast

[1] Farmers' Bulletin No. 218 on the school garden may be obtained free from the U. S. Department of Agriculture. It contains many practical suggestions of value to teachers of nature study.

GARDENING

A drawing lesson in charcoal.

fund of valuable information. If possible, let the pupils solve the problems as they arise, though the aid of the teacher should not be withheld when needed.

LESSON XLIII

OUR DAILY FOOD

Mention foods that are eaten at breakfast; at luncheon; at dinner. Arrange them in three lists, for the three meals, respectively. Which are necessities? Which are luxuries? Which are from the vegetable kingdom? Which are furnished from the animal kingdom?

Experiment. — Weigh each article of food in a sample luncheon. Estimate the cost of each. Find the weight and cost of the luncheon at prevailing prices. Breakfast and dinner will cost much more than luncheon. Estimate the

cost of these, and find, approximately, what our daily food costs. Discuss varieties and uses of foods.

Who furnish children their food? Discuss children's relation to their parents.

LESSON XLIV

HOW OUR BODIES GROW

Why do we get hungry? About how often do we get hungry? What good does the food that we eat do us? Compare human food and plant food as illustrated in the study of germination. When are we most hungry, after going on an excursion or long walk, or when we have been in the house all day? Which will eat more, the man who works hard, or the one who exercises little? What, then, does exercise use up which it requires food to restore?

Do we eat more in cold weather or in warm? What kinds of food do we like best in winter? in summer? Food builds up our bodies and keeps us warm. Discuss wholesome and unwholesome foods; the danger of eating too fast and too much; and the necessity of chewing well our food, and therefore, of having good teeth.

In this connection some lessons may be given on table etiquette: the proper use of knife and fork, spoon, napkin, etc.

Why do we prefer certain foods? When things taste good to us, what are we likely to do that will injure us? If things did not taste good to us at all, how might our bodies be injured? Name something that is sweet, sour, bitter, pungent, saline, etc. Let the pupils taste things having these flavors. Some things impair our sense of taste. We should avoid using much pepper, spices, and condiments.

LESSON XLV

THE SENSE OF SMELL

Let the pupils try to distinguish various things by their odor, *e.g.* fruits, flowers, foods, gases, etc. Discuss the value of the sense of smell. As often as may be convenient, cultivate this faculty by using it in connection with nature study work.

How may odor warn us of danger? The location of this sense above the mouth and within the passages used for breathing, enables us to discern quickly and reject many improper foods and drinks that otherwise might be inadvertently swallowed. Recall the effect upon smell of a cold in the head. Discuss how colds are contracted; their prevention and treatment; the use of a pocket handkerchief.

Name as many odors as you can distinguish; as many flavors as you can taste; as many colors as you can distinguish. Which of these three senses is used most? Which is least used by man? Which is most highly developed?

Discuss the wonderful powers of smell possessed by the lower animals. The dog follows his master by smelling his tracks. Bloodhounds are used, in this way, to capture criminals. A buzzard can scent a carcass at a very great distance, and is thus led to the food needed to sustain life. Deer often smell the approaching hunter in time to flee from danger. What occupations require a keen sense of smell? When is it useful in cooking? Of what use is it to the physician? How does the druggist use it? Does it aid the chemist? Why is illuminating gas given a strong and disagreeable odor? What other dangers are detected by this sense? How does the sense of smell afford us pleasure?

LESSON XLVI

VEGETABLE FIBERS—COTTON

At some suitable time, to connect with work in geography or domestic science, make a careful study of the cotton plant

DESIGNS FROM NATURE STUDY LESSONS

These designs were worked out in the domestic art department of the Utah State Normal Training School

and, perhaps, of flax, hemp, and manila. Get samples of the plants in different stages of growth and manufacture. Procure pictures of fields where grown, and of scenes illustrating the process of manufacture. The study of the vari-

ous industries that grow out of vegetable and animal products is of almost as much interest to the child as are plants and animals themselves, and connects naturally his school life and home life.

The planting and cultivating of cotton, a description of the plant; samples to show the pupils, if possible; ginning, and

BORDERS DESIGNED FROM NATURE STUDY LESSONS

the story of the invention of the cotton gin; descriptions of the various processes through which cotton passes in its manufacture, — all these may be given to pupils of this grade. Many geographical readers contain full accounts of this industry.[1]

[1] See "How the World is Clothed," by F. G. Carpenter. American Book Company.

THIRD GRADE

SUGGESTIONS TO THE TEACHER

Basis of Third Grade Work. — Having discussed the *home* and its simpler activities in the first grade, and the subject of *shelter* in the second grade, it is believed that the children of the third grade are now ready to emphazize the *sources of supply* of some of the many things that they have found necessary to their comfort. Therefore, this will be the basis of the lessons in this grade.

It is not the design of the author that these subjects are to be exhausted in the respective grades to which they are assigned, and therefore not referred to in subsequent lessons; but, on the contrary, the home life with its three great necessities—food, clothing, and shelter—is basic throughout the grades. These three great necessities form the mainspring of most human activities, and for this reason are necessary factors in any adequate system of education or course of study. The extent to which either one of them should be treated in any grade, however, must be determined by the age and experiences of the pupils in it. In rural districts pupils will be better acquainted with the agricultural occupations and products, with domestic and wild plants and with animals, etc., than will the children living in large cities, and can therefore pursue the study of such topics further; while the city pupils, being more familiar with the activities involved in manufacturing, commerce, etc., should have these topics developed further.

THIRD GRADE—FALL WORK

LESSON I

A VISIT TO A FARM

At the first favorable opportunity after school begins in the fall, a visit to some near-by farm should be made, unless the pupils live in a rural district and are already familiar with fall activities on a farm. A day spent on such a trip will give the children data for much nature work throughout the year, and can be appealed to constantly by the teacher for illustrations.

If the children have actually seen the great crops of hay, grains, fruit, and vegetables growing, and witnessed how each kind is gathered and cared for, and observed the machinery, animals, and buildings employed in connection therewith, they will have a most useful fund of knowledge with which they can interpret much of the nature work throughout the year.

Other things being equal, visit the farm which affords the greatest number of activities and kinds of crops. On many farms in the arid west there will be found acres of hay, grain, and root-crops, a good garden, fruits of many kinds, and a variety of domestic animals. In the east and south larger areas are planted to a single crop, as, corn, cotton, sugar cane, etc., offering fewer activities for observations.

The different varieties or breeds of horses, cows, pigs, sheep, and poultry, and the care given them and their usefulness to man are all interesting things to study by means of actual contact. The methods of irrigating, cultivating, and harvesting the various crops, the fall plowing and

planting, and the implements used in these activities, also should be studied.

Predatory animals and insect pests, the particular evil wrought by each, and the means adopted by the farmer to protect his animals and crops from them, also should receive attention.

Besides affording splendid opportunities for nature study, such a trip will form a theme for the choicest language work and art, and may be made the basis of the history and evolution of farming and farm implements. It thus becomes the natural means of the most valuable correlation of useful thought and knowledge.

Discuss subsequently each crop produced: how it is grown, harvested, and marketed. It will be found that the farm is the source of supply for a great number of the most necessary commodities. Base as many lessons upon the visit as may be advisable.

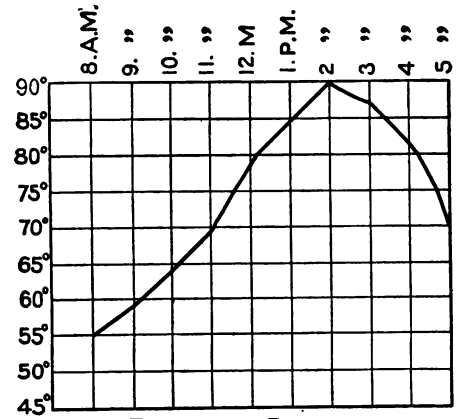
LESSON II

THE THERMOMETER

Every schoolroom should contain a thermometer. One may be purchased for twenty cents that will serve for ordinary use, but one that will indicate boiling point and be more accurate will cost one dollar or more. To tell the temperature of the air indoors or out, the thermometer should be so placed as not to receive undue heat from the stove or radiator, or from the rays of the sun.

Experiment. — Let the pupils examine a thermometer, breathe on it, etc., to see the mercury rise and fall. Explain its action. Plunge it into melting ice, if convenient. Note the temperature. Place it in boiling water. Note this temperature.

By putting the bulb into the mouth, "blood" heat may be determined. Experiment with it until the pupils are satisfied that it is uniform and reliable in recording temperature.



TEMPERATURE RECORD

Application.— Give the story of its invention, and explain the gradation and its meaning. Let the pupils read the thermometer, and record the temperature at 9 A.M., at 12 M., and at 4 P.M. each day for a few weeks. A graphic record of these observations may be kept on the blackboard.

LESSON III

CHANGE DUE TO TEMPERATURE

How does a considerable rise in temperature affect us? How do we feel when it falls many degrees? What is the proper temperature for the schoolroom? A change of only a few degrees either way makes us uncomfortable. What is the difference in temperature between morning and noon? between day and night? Explain this difference. Find from the Weather Bureau maps, the maximum and minimum temperature for several days in succession, and compare with the observations of the pupils.

How does temperature affect the activities in the home?

Discuss the drying of clothes and of fruit, and perform some simple experiments to show how heat influences, in a general way, evaporation under various conditions.

Note the temperature when it storms. How is it affected by rain? by wind? by snow? Is it ever very warm when it snows? Is it ever very cold when it rains? What effect would heat have upon falling snowflakes? What effect would cold have upon falling raindrops?

Note the temperature when the first frosts come. What plants are most injured by the early frosts? Discuss tender and hardy plants, and notice how the frost-bitten leaves of the former look. Discuss at proper times the effects of frosts, and the changes that plants undergo as the temperature gets lower in the fall. Do plants protect themselves in any way from the frost? How does the farmer protect his crops of fruits and vegetables from the frosts? Discuss fruit cellars, potato pits, etc. Are dry crops like wheat, corn, etc., injured by cold? Why not?

Much valuable number work may be given in connection with the study of temperature. Average and compare temperatures of weeks and months, and cultivate the children's judgment of the temperature of air and water, by practice.

LESSON IV

DEW

In keeping the record of the temperature, make frequent comparisons of weekly averages, and note the rate of change. Also call attention to the effect of these changes upon animal and plant life, so that the pupils may see the relations between the changes in temperature and other changes about them.

In this connection a lesson on dew and conditions under which it is formed will be appropriate. Have the children describe dew. Where is it found? On what things does it form? On what things does it not form? When is it formed? Does it form on nights that are clear? cloudy? warm? cool? windy? calm? Where does it come from? What is the effect of a wind upon the formation of dew? What is the effect upon dew of extreme heat? of extreme cold? What good does it do? Does it ever do harm?

Discuss the heavy dews of the tropical regions. Breathe upon the cold window pane, or perform other simple experiments to show how water comes from vapor.

NOTE. — Dew is formed when warm moist air comes in contact with cool substances that condense the moisture. Plants lose their heat more rapidly than stones and other common objects, and therefore condense more moisture generally. In the arid regions where the ground is irrigated, grasses, rather than tall trees, catch the dew, since the moisture comes chiefly from the ground near them. In tropical forests, however, the trees drip with dew condensed from the upper currents of the moist air from the ocean.

LESSON V

FROST

When the night is very cold, what forms instead of dew? Examine with a lens some frost crystals. Are they frozen drops of dew?

Explain that the crystals are formed gradually from the vapor, which does not condense first into drops and then freeze into ice; the frost crystals, at first very small, grow gradually larger by the addition of more vapor condensed and frozen simultaneously.

What effect has frost upon plants? Examine some frost-bitten leaves or vines in the class. What plants withstand the frosts longest? Which are first killed by the frost? When did the first "killing," or severe, frost occur? Did it do much damage?

Discuss tender and hardy plants, and the methods of protecting the former from the frosts. Discuss the greenhouse and artificial coverings. Smudges of crude petroleum and damp straw are used to protect orchards from an untimely frost. A change of a single degree in the average temperature in our northern latitudes would make the greatest change in plants that would grow there, by lengthening or shortening the season. What plants cannot grow wild in our northern latitudes on account of the frosts?

Does any good come from having frosts or exceedingly cold weather? Dig in the earth and find how far the frost penetrates. Explain how it disintegrates rocks, both large and small, just as it bursts the water pipes or water pitcher. It does the soil the greatest good, and may be called nature's plowman. What influence has the locality upon the formation of frost? Does it fall first in the valley or upon the bench land? Discuss other physical effects of frost.

The Frost

The frost looked forth one still, clear night,
And whispered, "Now I shall be out of sight;
So through the valley and over the height,
In silence I'll take my way;
I will not go forth like that blustering train,
The wind and the snow, the hail and the rain,
Who make so much bustle and noise in vain,
But I'll be as busy as they!'

Then he flew to the mountain, and powdered its crest;
He lit on the trees, and their boughs he dressed
In diamond beads; and over the breast
Of the quivering lake he spread
A coat of mail, that it need not fear
The downward point of many a spear,
That he hung on its margin, far and near,
Where a rock could rear its head.

He went to the windows of those who slept,
And over each pane like a fairy crept;
Wherever he breathed, wherever he stepped,
By the light of the morn were seen
Most beautiful things; there were flowers and trees;
There were bevies of birds and swarms of bees;
There were cities with temples and towers; and these
All pictured in silver sheen!

But he did one thing that was hardly fair, —
He peeped in the cupboard, and finding there
That all had forgotten for him to prepare,
"Now, just to set them a-thinking,
I'll bite this basket of fruit," said he,
"This costly pitcher I'll burst in three;
And the glass of water they've left for me
Shall 'tchick!' to tell them I'm drinking!"

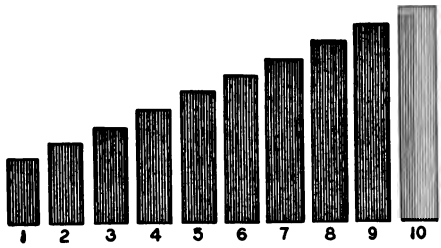
— HANNAH F. GOULD.

LESSON VI

CAUSES OF TEMPERATURE CHANGES

Recall the work on weather done in the lower grades. Whence comes the heat that influences our weather? Why is not the amount of heat that comes to us from the sun always the same? What changes take place in the sun's position each day? What part of the day is hottest?

Account for this. When is it cool? Why? Give examples from the children's observations which illustrate the difference in the heat of direct and slanting rays.



LENGTH OF SHADOW — BLACKBOARD ILLUSTRATION

What changes take place in the sun's position during the year? In what month is the noon shadow longest? Where is the sun at that time? In what month is the shadow shortest? Where, then, is the sun? How does its heat strike the earth in each case? Describe the sun's daily path in winter; in summer.

While studying the length of the noon shadow — and therefore the changes in the path of the sun, — the teacher will aid the class greatly by using graphic or objective representations of their observations. At the end of each week draw on the blackboard a rectangle representing the shadow cast on the shadow-stick, and occasionally call attention to the gradual change in length. Date or number each week's shadow.

If the pupils can at the same time observe the sun rise and set, the length of the day should be determined by them and may be written once a week over the week's shadow representation. They will no doubt soon discover a relation between the two. The changes gradually taking place in the average temperature may also be noted and related to the other observations.

When do we have the longest days? When do we have

the shortest days? Does the length of the day affect the temperature? Why? Will more heat come to us during a long day than a short one? Explain why. When it is warmest, how does the sun's heat strike the earth? What, then, are the chief reasons why it is cold in winter and warm in summer?

Find by observation, the week containing the shortest day in the year; the longest day. Which should be the coldest month? Why? The hottest month? Why?

LESSON VII

FRUITS—RELATION TO THE PLANTS

Secure, with the aid of the children, a collection of fruits containing as many varieties as possible. With these samples before the class, discuss the nature and uses of fruits.

What is a fruit? What is the difference between a fruit and a vegetable? What is nearly always found in fruit that is very important to the plant? What would happen in a few years to the peach tree, for example, if all peach trees should cease to bear fruit? What, then, is the most important part of the fruit to the tree?

Name all the fruits that grow in the vicinity. Name others that you are familiar with. Which grow on trees? Which grow on vines? Which grow on bushes? Make a list of each kind. What fruits grow wild? Which are larger and better, wild fruits, or those that are cultivated?

Once, most fruits and flowers grew wild and were small and inferior. How did man improve them? What is the difference in the plants of a neglected garden and those of the same kind in a well-cared-for garden? By care and cultivation for many years, man has greatly improved fruits.

How do wild fruits plant themselves? Do all seeds fall at the foot of the parent plant? If they should, would they grow and thrive there? Why not? How do the fruit trees contrive to get their seeds scattered, where some of them, at least, may find a good place to grow?

In this way develop the fact that the fruit accompanying the seed furnishes food for birds and other animals, and that the latter often scatter the seeds while eating them or taking them to their young. Since plants cannot travel themselves, the fruit is made to induce animals that can travel to do the work of scattering the seeds. Keep this purpose before the class during the few following lessons on fruits; and where cultivation has changed the fruit much, keep in mind its condition when wild, and the animals that each kind depended upon to do its work.

LESSON VIII

FRUITS — SIZE AND SHAPE

Let the pupils arrange the samples of fruit according to size. This will cultivate their mathematical judgment. What is the difference in the price of large peaches and small ones? Is there any advantage to the tree in making its fruits fine and large? Why are large oranges dearer than small ones? Which cherries do the birds select, large ones or small ones? Which seeds are most likely, then, to get scattered, those of the fine large fruits or those of the undeveloped, small fruits?

Why should fruits of different kinds vary so much in size? What animals eat squashes? Do the same ones eat cherries? Show that some fruits are adapted as food

for one kind of animal, while other fruits are adapted for other animals.

Why does the squash grow on the ground and the cherry on a tree? What disadvantages would there be if these two fruits should change places of growth? Show that each fruit is adapted to the plant on which it grows, and that by growing there it is in a convenient place for the animal that uses it for food.

What shape have most fruits? Why are they spherical? A sphere is the most compact form. It is a convenient form, as it has no corners to get bruised; it is likely to roll some distance, as it falls from the tree, and this aids in scattering the seeds; it is also one of the strongest forms. These and other points may be developed and illustrated with objects and examples. Would a cube be as good form for an egg? Why? Is the shape of our skull an advantage?

LESSON IX

FRUITS—COLOR AND TASTE

From the samples select all the red fruits; all the green; purple; yellow, etc. Place them in different groups according to color. Which color is most used by fruits, judging from these samples? Let the pupils arrange the different members of each group in the order of their shades, *i.e.* have them place on the extreme left the fruit of the deepest green, then the fruits having the next lighter shade, until at the right will be found the pale greens merging into yellow fruits. Arrange each color in this way, and the exercise will prove beneficial as a lesson in colors, shades, and tints.

What is the commonest color among the large fruits, as

squashes, melons, gourds, etc.? Why? What is the commonest color among the small fruits, as currants, cherries, berries, etc.? Account for this. What color is seen farthest in the sunshine? Would green currants be seen as readily as red, by a bird flying over the bush?

Let the pupils look out of the window at recess and notice among the children on the playground how a red dress or ribbon attracts the eye as compared with other colors. How, then, would this color affect a bird flying over trees and bushes?

When do the bright colors appear on fruits? What is the condition of the seeds within? What is the seed's condition in unripe fruit? What is the taste of unripe fruit? Would the seed grow then, if planted?

Develop the fact that the color and flavor of the fruit reaches the greatest perfection just as the seed becomes fully developed and is ready to be scattered. Hence, these qualities are evidently inducements to get animals to do the work, while in previous stages both color and taste are repulsive and protect the immature seed.

LESSON X

FRUITS—ODOR AND SENSE TRAINING

Let the pupils close their eyes and try to detect different fruits by their odor. This will prove an interesting and profitable game, or exercise. A certain pomologist in the employ of the Agricultural Department is said to be able to tell the variety of any apple by its odor.

When is the odor of fruits strongest and most agreeable? What can you say of the odor of fruits when green? Like

color and taste, the odor reaches its best when the fruit is ripe. Of what use to the plant is the odor of its fruit? Do animals have a sense of smell?

Recall the fact that the dog can follow his master by smelling his tracks. Explain the use of bloodhounds in tracing animals and criminals. Buzzards are said to be able to scent a carcass one hundred miles away. It is not unlikely, then, that the odor, as well as other properties of fruits, is designed to attract animals in order that the seeds may be scattered.

A good exercise to cultivate the sense of taste is to cut into cubes, or similar shapes, the pulp of several kinds of apples, pears, or other fruits, and let the pupils determine the kind from the taste.

LESSON XI

FRUITS—CLASSIFICATION

Cut open samples of the fruit to examine how they are made, and the use of each part.

What do we find on the outside of the apple? What is the use of the thin, smooth skin? What will happen to the apple if this be broken or a portion removed? Why do worms most often enter the apple at the blossom end, or where one apple touches another?

Compare the skin, or rind, of various fruits, to bring out the general and particular uses and adaptations of this covering.

What lies next within the skin? Of what use is the flesh, or pulp, of fruits? This is usually the edible portion, and its use has already been described. Compare the pulps of different fruits.

What next comes inside the pulp, or flesh? In case of the apple, it is the core. Of what use is the core? Is it good to eat? It will be rejected, with the seeds contained within, by the animal eating the apple, thus preserving the seeds. What other fruits have a structure similar to that

NATURE STUDY SCRAPBOOKS

The above cut represents two large scrapbooks filled with pictures collected by the pupils. They illustrate two topics of nature study. The first one is closed, the second is open.

of the apple? These may be grouped by themselves and called *pomes*. They include the apples, pears, quinces, haws, etc.

The *berry* family have a skin encircling a juicy pulp throughout which are scattered many seeds. To this family belong the gooseberry, currants, tomato, and a great many of our small and useful fruits. Are strawberries, blackberries, and raspberries true berries?

In like manner it may be shown that some fruits have a more or less glossy skin, a soft pulp, a stony seed box within. These are called *drupes*, and embrace the peach, plum, cherry, prune, etc.

Those covered with a thick, bony rind, and a more or less

solid pulp, within which are numerous seeds, are grouped into the *gourd* family, and comprise the melons, squashes, cucumbers, and gourds.

Classify all the fruits into these families, as far as possible. Let the children make each classification.

They should also discover adaptations of structure to conditions and needs of the plant. For example, of what advantage is the thick, bony rind of the squash? To what danger would it be subject if it were covered with the soft skin of the peach? Why is it safe for the latter to have so soft a covering?

LESSON XII

FRUITS—CANNING, ETC.

Examine with a lens some mildewed or moldy fruit. The mold resembles moss or other vegetation. How did this vegetation come to grow upon this specimen of fruit? How do weed seeds come to grow in our garden? Have you ever seen dandelion seeds scattered by the wind? If these seeds fall upon moist earth, they settle there and begin to grow, but if they fall upon a stone, or board, or dry, hard walk, they do not grow. In the same way the seeds, or spores, which produce the mold, float in great numbers in the air; they are so small that we fail to see them unless, perchance, in a sunbeam that enters a dark room. The dust then visible may be in part these seeds or spores. What will happen to these seeds if they come in contact with a moist, bruised part of an apple or a peach? What will happen if they come in contact with the smooth, dry skin? Then why is it dangerous to break the skin of fruit which we wish to keep?

What effect does cold weather have upon sprouting seeds? Then why do we put fruit in cold storage?

What effect upon their power to grow has heating seeds very hot? Then why is fruit put into cans or bottles boiling hot? The can or bottle serves as a skin to keep spores from the fruit after it is canned. If the can or bottle leaks, why does the fruit spoil?

NOTE. — Since we are studying fruits in their relation to seeds, it may not be desirable to discuss the influence of fermentation upon preserving fruits in this connection; it will be correlated better in another place.

LESSON XIII

FRUITS — DRYING AND PRESERVING

Have the pupils bring some fruit, and dry it at school. Remove the skin and seeds, or the refuse parts; weigh a given amount, and put it in such a place as will insure rapid evaporation. Weigh the samples at intervals, and note and account for the loss in weight.

Why should the fruit be spread out and exposed to the air? What happens if it is piled up too thick, or put in an unfavorable place so that it does not dry quickly? Explain why it molds. What forms quickly over a piece of fruit properly placed to dry? What would be the effect if a mold spore, or seed, should come in contact with this dry, skin-like covering? But if this covering is a long time in forming, the spore has time to grow.

Describe the drying of fruit on a large scale. If possible, visit a fruit evaporator. Show pictures of one and samples of fruit dried in one. Discuss the subject in its social and industrial phases.

Find the percentage of water in various kinds of fruit by weighing them before and after drying.

What can you say of the power of pure sand or clay to sustain vegetation? Seeds do not grow in pure clay. There are also fruit products that will not sustain mold. Sugar is not a good soil for mold, and therefore fruit may be preserved in it by boiling the fruit in a rich sirup of sugar.

If fruit that is canned or preserved begins to spoil, it should be heated at once. This kills the spores if there be any, and at the same time arrests fermentation.

LESSON XIV

SEED DISTRIBUTION—FIELD LESSONS

The study of fruits from the new point of their use to the plant, naturally leads to the study of seed distribution in general. Take the children out for a field lesson, where they can see that in almost every place some kind of plant may be found growing.

Also, if possible, take the pupils to some near-by farm and let them see how man takes care of the seeds he raises; how he plants them; and how, by furnishing better conditions than nature does, he gets better results.

They should see the stacks of hay and grain, the corn shocks and granary, corncrib, fruit cellar, potato pit, etc., and learn the use of each. They will discover that different seeds require different care and treatment, and are planted differently and at different times, according to the nature and habits of the seeds and plants. After seeing how man does this, they will more readily discover how nature does it and the purpose in it.

LESSON XV

SEED DISTRIBUTION—PLANTING BY MAN

Does man plant any seeds in the fall? (Wheat and other grains, lucern, and many kinds of seeds may be planted in the fall.) Discuss fall wheat planting and its advantages, especially on dry farms in the arid regions.

The seed is sown very deep early in the fall when the earth is very dry; if it were not, a light shower would sprout the seed, which would then die in the succeeding dry weather. But, being placed so deep, a heavy rain, such as we often have early in September, is required to reach the seed and make it grow. The ground is then so wet that the wheat acquires a large stem and a long root, enabling it to survive any dry weather that may follow. It goes into winter, then, in a condition to take advantage of spring showers, and thus succeeds in maturing its grain before the severe drought of summer comes upon it.

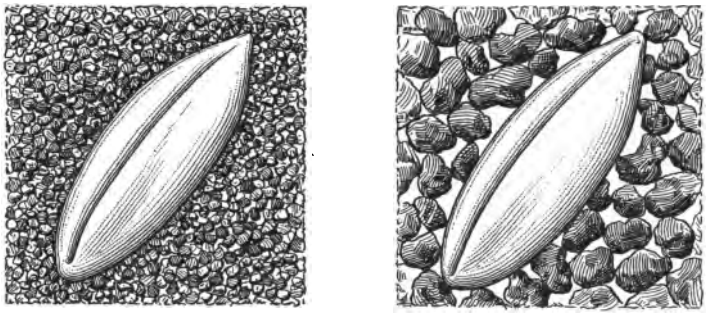
Some seeds, as the stone fruits, need the action of frost to split open the seed covers and to prepare the seed to grow when spring comes. These should be planted in the fall.

As all seeds planted by man are valuable, he strives to place them in the earth in such a way that every seed will grow. He therefore takes great pains to prepare the soil in the best way to receive the seeds and to sow them to the best advantage.

Which seeds are sowed in hills? Which are sowed in rows? Which are sowed broadcast? Which are placed deep in the soil? Which are planted near the surface? Give a reason for each way of planting seeds.

Discuss, also, why the soil should be finely pulverized, so as to surround the seed closely and bring to it the moisture and

warmth of the soil. A seed lying among coarse chunks of earth would be touched by it at only two or three points, and could, therefore, get little good from conditions present in the soil.



GRAINS OF WHEAT IN DIFFERENTLY PREPARED SOILS

If the ground is packed too firmly about the seed, as is sometimes the case in clayey soils, the stem and root may not be able to push their way through it and develop properly.

What does the farmer do to get the soil in proper condition for the germination and growth of plants?

LESSON XVI

SEED DISTRIBUTION — BY ANIMALS

As plants cannot move about to distribute and sow their seeds, they must arrange their seeds so as to secure the assistance of some agent that can do this work.

Do animals assist plants in this work except in taking the fruit for food as already described? In what other ways do the plants contrive to get animals to scatter their seeds? Have the pupils collect, in a box, samples of all the seeds

having burs, hooks, prickles, etc., and illustrate how these are attached to animal coverings and carried away.

Discuss the size, covering, food, etc., of the animals doing this work and the corresponding size, location, and nature of the plants bearing such seeds; also the inducements present to get the animals in contact with the seeds.

Do burs grow on trees, or shrubs, or grass? Why not on trees? Are the plants bearing them good for the food of the animals that carry them away? If not, does grass or other animal food grow in the same parts? When the seeds stick to an animal's covering, how may they get planted? There are other ways in which animals distribute seeds. Discuss samples gathered by children.

LESSON XVII

SEED DISTRIBUTION — BY THE WIND

What agent besides animals aids in scattering seeds? Collect samples of seeds that have pappus, wings, or other appendages that might cause them to be moved by the wind. Put these in a box by themselves. Notice where such seeds have been distributed by the wind, and where plants are growing from them.

The milkweed, dandelion, tumbleweed, thistle, maple, box elder, and many other common plants have seeds that are distributed by the wind. Even the large curled pod of the honey locust may be seen rolling over and over on the hard ground, propelled by the same agent.

Study in detail one or more such plants, *e.g.* the dandelion. Notice that however low the plant is, when the seed is ripe, the seed stock lengthens, so that the wind has the best

possible chance to do its work. At the proper time the seeds become loose so that a faint wind will take them off.

LESSON XVIII

SEED DISTRIBUTION — BY WATER

Besides animals and the wind, what other agent sometimes distributes seeds? Test many kinds of seeds, and find which will float on water. What plants grow on or near water? What kind of seeds have they? Examine ditches and banks of streams. Note the vegetation growing there, and account for its presence.

How may the land of a careful farmer become weedy by using irrigating water that flows through the field of a careless neighbor? Many seeds are carried on the water and distributed in this way. Collect and preserve samples. Discuss the cocoanut in this connection.

LESSON XIX

SELF-DISTRIBUTING SEEDS, ETC.

Some plants arrange to distribute their own seeds. Some pods, when they get dry, suddenly burst and throw the contained seeds several yards away. The squirting cucumber is filled with juice in which the seeds float. At the proper time this ferments, developing enough gas to burst the cover, and sends the floating seeds quite a distance. Vines often grow a great distance, and develop fruit and seeds a long way from the parent root and stem.

In the activities of commerce, seeds are often accidentally scattered by man. In this way Old World plants have been introduced into the Western Hemisphere, greatly to our

detriment. Along lines of railroads will be found many plants unknown elsewhere in the country, coming in the freight brought from other lands.

Useful seeds, man brings from all nations to improve our supply and increase our wealth and profit. Give examples.

A very instructive exercise is to collect on a field trip all manner of seeds, and on returning to school classify them according to their methods of distribution. Many seeds are adapted to be distributed by two agents, as wind and water, while it will be exceedingly difficult in other cases to determine in what way some seeds are distributed. The benefit to the pupil is derived more from the thought aroused than from the correctness of the solution of the problem.

LESSON XX

KINDS OF SOIL

Take the class for a field lesson to places where there are different kinds of soil. What places sustain abundant vegetation, wild or cultivated? What places produce little? Account for this. Examine samples of soil.

Collect and take to school samples of gravelly, sandy, and clayey soils, and of rich garden loam. Which are good, and which are poor? Give a reason for each answer. Where is gravel generally found? Where is there much sand? Where are the best farms and gardens?

When the pupils are familiar with the different kinds of soil in their own locality, they may be led to understand why certain countries are richer than others in farm products, and why certain places are populous and others uninhabited.

The children should be able to judge soil in a general way when they see it, and tell if it is good or poor soil.

THIRD GRADE — WINTER WORK

LESSON XXI

CHANGES IN ANIMAL COVERING

What changes do most of our winter dwellers make in their coverings in the fall? Mention as many as possible that put on a heavier, warmer coat. When does this coat change for a lighter one? Discuss fully these changes in domestic and wild animals; and the necessity for it. If possible, get samples of the summer and winter coats of the same animal.

Do any animals change the color of their coat? Account for this. Discuss the weasel, which is white in winter and gray in summer. Some rabbits also change color as a means of protection from enemies. Birds often make similar changes. The snake, toad, and other animals shed their skins at certain periods. Account for this.

The structure, changes, and uses of the various coverings of animals will afford material for many interesting lessons according to the knowledge of the teacher and the opportunities of the pupils to do observation work along this line.

LESSON XXII

MIGRATORY ANIMALS

Mention animals that leave us for the winter and return in the spring. During the fall months a record of the birds, insects, and other animals seen each day should be kept, and thus the time of their disappearance discovered.

What reasons can be given for the migration of birds? Let the pupils suggest and discuss: (*a*) the weather; (*b*) the food supply; (*c*) the lack of foliage, shelter, etc.; (*d*) their powers of locomotion as compared with animals which do not migrate; (*e*) their intelligence compared with others; (*f*) the dangers and fatalities in making the flight; and any other conditions that will make clearer the subject of the migration of birds. Tell stories illustrative of the same.

It is said that less than 25 per cent of the birds that leave us ever return. It might be interesting to do a little number work in this connection. Suppose the life of a robin is ten years and that a pair will produce ten young each year. If none were killed, find how many there would be at the end of each year — say, for five years; for ten years, etc.

Do any animals besides birds migrate? Discuss in a similar way these animals and their reasons and times for migrating; the distances they go and the differences in conditions that they encounter.

NOTE. — Most animals that roam in herds move from one feeding ground to another at somewhat regular intervals. The deep snows of winter drive many animals from the mountains into the warmer valleys. Many fishes swim upstream at certain seasons to spawn.

LESSON XXIII

METAMORPHIC ANIMALS

Notice the disappearance of butterflies and moths. Where do they and other insects live during the winter? What is their food? Is there enough during the winter? If food were abundant, could they stand the rigors of winter weather? Do they migrate as the birds? Are they capable of making so long and dangerous a journey?

In this way cause the pupils to see that insects must have a different way of passing the winter than the animals heretofore studied. If not too late, some caterpillars may be found and placed where the children can see them make their cocoons: possibly in the spring the children may discover them hatching out as perfect insects.

NOTE. — From actual observation during the year the pupils should learn the various stages in the cycle of insect life. Use good pictures when the real object cannot be seen, but never otherwise.

A special study of the silkworm should be made in this connection, and, if possible, a visit be made to a silk factory. Many pictures of the silk industry can be obtained easily, and, where practicable, a colony of silkworms should be raised in or near the school in the summer. It is a very profitable industry, and its processes are simple, yet very interesting.

LESSON XXIV

ANIMAL COVERINGS

Name the different kinds of coverings that animals have to protect themselves. Make the list as complete as possible. It may include feathers, fur, hair, wool, bristles, spines, scales, shells, skin, etc. Each of these coverings may form the subject of one or more lessons. Only a few can be discussed here in detail.

Have the pupils bring samples of as many different kinds and sizes of feathers as they can get. Have them tell from what bird each came.

Where are the largest feathers on the bird found? What is their chief use? What is the chief use of the smaller

feathers? Is there any difference between the summer and winter plumage of birds? Discuss molting, etc.

How does the plumage of the birds of the Arctic region compare in warmth with that of the birds of the torrid zone? Discuss the eider duck and the down obtained from it. Show the fine downy feathers found in winter on our own birds near the quills of the larger feathers.

Examine a large feather, and note its use; the use of the central shaft or vein; of the barbs and barbules. Discuss how and why birds preen their feathers. Separate the barbs into shreds. How would the feather now sustain the bird in flight? Rub gently in the right direction until the barbs again interlock and the feather is perfect, as at first.

How are feathers placed on the bird? Discuss their layers, direction, overlapping, etc., and reasons. Notice also the modifications for the needs of the owners, *e.g.* the need of the duck's waterproof covering; of the owl's fluffy feathers giving a silent flight, etc.

LESSON XXV

ANIMAL COVERINGS — FUR

Visit a fur store. Learn to recognize the furs of various animals. Secure as many samples of fur as the proprietor is willing to give to the school, and get him to pin a ticket to each, bearing the name of the animal from which it was taken.

Study the different processes through which the various furs are taken in cleaning, tanning, coloring, and making into rugs and garments.

Note the prices of finished products and how they are

influenced by the abundance of supply or by the quality of the fur.

Make a list of fur-bearing animals. Where are they found? Why? Are they large or small animals, generally? How do they compare in size with animals that are covered with hair? Does fur protect from anything but cold? What other covering would be a better protection from the bites or kicks of enemies? Would such a covering be as suitable as fur for the fur-bearing animals? Why not?

Examine and compare different kinds of fur. Of what use is the "over hair" found on most furs? Explain how the fur is kept light and fluffy, and in this condition is warmer than if matted into hard masses. The warmth of fur depends upon its being a non-conductor of heat; and this in turn depends largely upon the amount of air held entangled among the fibers of the fur.

The manufacture of felt, and especially of felt hats, if illustrated by a visit to an establishment doing this work, or by pictures, will be good work for this grade.

LESSON XXVI

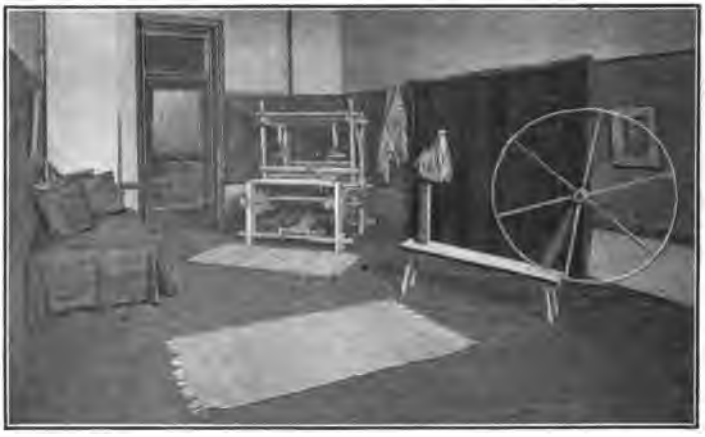
ANIMAL COVERINGS — WOOL AND HAIR

Get samples of wool, if possible, as it comes from the sheep. Show pictures of different kinds of sheep, and compare the wools they produce. Which are long? coarse? fine? short? Visit the State Fair and study the different breeds of sheep usually on exhibition at such places.

Discuss the uses of wool to the sheep. When is shearing done? Why? Describe sheep shearing. How many pounds of wool in an average fleece? If the shearing is

done too early, what loss is likely to come to the owner? What suffering to the sheep? Tell what you can about sheep herding, and the habits and characteristics of sheep.

Examine closely the fibers of wool. Compare them with



OLD-FASHIONED SPINNING WHEEL AND LOOM

Some of their products made by pupils of the Utah State Normal Training School are shown as furnishings of the room.

hair. Twist a few fibers of each into a string, and compare results. The fibers of wool cling together and form a very strong yarn which adapts it for making cloth.

If possible, and if they have not already done so, the pupils should visit a woolen factory and study all the processes of manufacturing wool. If such a visit is not possible, show the pupils a pair of hand cards and explain the process of carding, or combing, the fibers into one direction; of spinning them into a long yarn; and of weaving them into cloth.

Each pupil should wash, card, spin, and weave a portion of wool into some useful article and study these processes.

An old-fashioned spinning wheel and loom are also good things to study.

In a similar way a lesson may be given on animals having hair for a covering. These are usually larger than fur-bearing animals or sheep. Discuss the uses man makes of hair and the methods of treatment he gives it.

LESSON XXVII

ANIMAL COVERINGS—VARIOUS KINDS

What animals bear bristles? Are these to keep the animal warm? What has the pig to keep it warm? The layer of fat under the skin is a non-conductor of heat, and the pig needs no warm outer covering to keep it warm. What use is made of the bristles?

What animal bears spines? What is their chief use to their owner? Does man use them for any purpose? Give examples of their use to animals having them.

Discuss the scales of a fish, of a snake, or the larger plates of the alligator, and show how the size, position, strength, and peculiarities of these coverings serve the needs of their respective owners. Show samples, if possible.

Let the pupils handle a fish and note how slippery it is, made so by a gland which secretes an oily fluid over the scales, lessening the friction of the fish through the water.

The shells of the turtle family and their uses to the animals and to man also should receive attention, while many lessons could be given with profit on the shells of sea-inhabiting animals.

The tough, bare skins of the elephant, rhinoceros, and hippopotamus, which in some instances have been known to turn a bullet, will form the basis of a very interesting lesson.

LESSON XXVIII

THE HUMAN SKIN

The nature and use of the human skin may best be taught in connection with other animal coverings. Compare the skin of the palm with that on the back of the hand. Note the color, thickness, markings, sensitiveness, etc., of each, and assign reasons.

What effect has hard manual labor upon the skin in the palm? Why does the hand at first blister and not afterwards? Which becomes "water soaked" first, the palm or the back of the hand, if kept long in warm water? Why? Examine with a lens the fine hairs on the back of the hand. A small oil gland near each supplies the surface with oil to keep the skin soft. Cold wind may harden this oil so that it cannot spread over the skin; the latter then dries and cracks open to the sensitive skin underneath. The natural remedy, then, for chapped hands is a little animal fat, — mutton tallow is excellent. Gloves or proper warmth secured in any way is the natural preventative.

In hot weather, or during vigorous exercise, what comes freely from the skin? Is perspiration pure water? Prove by tasting, or by evaporating a few drops on a piece of glass, that it contains many impurities. Free perspiration, therefore, is one way of preventing sickness. As it evaporates, it has what effect upon the heat of the body? Perspiration is also a *heat regulator.* How? Why should we bathe often?

What becomes of liniment rubbed on the skin? How does contact with the leaves of poison ivy introduce poison into the blood and cause painful sores? There are in the skin very small absorbent glands that take up many things that

touch the body. Discuss the use and dangers of this power of the skin.

The sense of touch is located in the skin, also. It is most sensitive in the fingers and in the tip of the tongue, where it is most used. Give the pupils practice in distinguishing things through their sense of touch.

LESSON XXIX

HEATING OUR HOMES

How do we keep warm in the winter? How do we keep out the cold from our homes? What is used as fuel? Discuss coal, wood, coke, charcoal, oil, and gas, as fuels, and how each is used.

Make a special study of a stove. Name and explain the uses of all its parts, *e.g.* the legs, ash pan, grate, fire box, damper, doors, openings in the doors, the stovepipe, chimney, etc., and, if it be a cooking stove, discuss also the oven, lids, the space around the oven, how and why it is cleaned, etc.

If the schoolhouse has a steam- or water-heating plant, visit and study it. Follow the heat from the boiler to the schoolroom. Note how the fresh air is introduced and heated, and how the temperature in each room may be regulated.

Study a grate, range, furnace, hot-blast stove, etc., and compare corresponding parts with the stove first studied. Notice particularly in each case how the supply of fuel and air is regulated and the effect of increasing or diminishing either upon the amount of heat produced.

A common coal oil lamp has all the essential parts of a

stove, and may be used before the class for a lesson. The oil is the fuel, supplied through the wick and regulated by the raising or lowering of the wick. The chimney creates a draft, supplying air for combustion, and conducting the gases that are the product of combustion. As no ashes are made, no ash pan is needed. For legs, it rests upon a stand.

Let the pupils themselves discover all these resemblances, and they will better understand the principles of combustion.

LESSON XXX

FIRE MAKING

How do we build a fire in a common stove? Why do we first put in paper or shavings? Why do kindlings come next? What common fuel takes longest to start? What things take fire easily and quickly? What accidents often occur because of this? Is it safe to pour coal oil on a slow-burning fire to hasten it? Why not? Some substances ignite with very little heat, while others require a greater degree.

Experiment. — On a piece of tin, place a small piece of phosphorus, of sulphur, of wood, and of coal. Hold the pieces over the flame of an alcohol lamp or bunsen burner, keeping the tin moving so as to equalize the heat under each of the substances. Notice the order in which they ignite. A very little heat starts the phosphorus; the sulphur is next, then the wood, and the chances are that the coal will refuse to burn altogether in this experiment. The degree of temperature at which substances begin to burn is called the kindling point, or flash point.

Application. — From this experiment let the pupils suggest how they would make a match, which begins to burn with the slight heat created by rubbing it on a rough surface. Why use wood for the body of the match? If the end be dipped into melted sulphur, will that make a satisfactory match? Why is it capped with phosphorus? Just as the paper or shavings in burning create enough heat to fire the kindlings, which, in turn, makes the coal hot enough to burn, so the phosphorus makes enough heat to start the sulphur, and the sulphur then produces enough heat to ignite the match.

This is the history of fire making in modern times. The teacher may discuss in another lesson the ancient ways of doing it.

LESSON XXXI

LIGHTING OUR HOMES

What are the principal kinds of light used to light our homes at night? Tell how the candle is made. If possible, make some such as were used a generation ago. Compare the lighting power of a candle with that of our ordinary lamp. Discuss the materials from which candles are made now, and those from which were made the candles used by our grandmothers.

Study a coal oil lamp. Name and describe its parts and their uses. Note how it is supplied with air and oil, and the effect of curtailing the supply of either. How do accidents often happen with such lamps? Teach pupils caution in using them.

Where does gas come from? How is it made? How does it get into our houses? Examine the gas pipes and fixtures.

Note how the gas is turned on and off. Visit the gas works, and study them. What danger is there in blowing out the gas and going to bed? Compare the light of a gas jet with that of a lamp or candle.

How does electricity get into our houses? Show and explain to the children, where possible, the wiring for electric lights. Turn off and on the lights. Take apart the switch, and show the pupils how the circuit is broken or completed, as we turn off or on the lights. Compare the intensity of the electric light with that of others. Call attention to its many conveniences and safety. Note how easily and quickly a large building is lighted and its lights extinguished, when electricity is used.

Compare with primitive methods of lighting, when the log fire or pine knot furnished the home its light. The first lamps were supplied with a wick reaching into a bowl of oil, the upper end lying in a groove and reaching somewhat beyond the edge of the bowl. Follow the evolution of lights for our homes.

LESSON XXXII

BREAD MAKING

THE SONG OF THE WHEAT

Back of the bread is the snowy flour;
  Back of the flour is the mill;
Back of the mill the growing wheat
  Nods on the breezy hill;
Over the wheat is the glowing sun
  Ripening the heart of the grain;
Above the sun is the gracious God,
  Sending the sunlight and rain.

—SELECTED.

What article of food is most common? Mention the different forms in which bread is made. Discuss loaves, rolls, biscuits, etc. From what is bread made? Discuss bread made from other than wheat flour, *e.g.* graham, corn, rye, etc.

Where is each kind used most commonly? Why do they eat so much corn bread in the Southern states? Where is a great wheat region? In some countries of Europe they raise much rye, and that kind of bread is eaten there.

Discuss bread making as done at home, describing each step, and as far as possible giving reasons for it. Bring to school a small glass of yeast, and show how the bubbles of gas are formed and how they make the bread light.

Experiment. — Drop a small portion of baking powder into a glass of clear cold water. Watch the bubbles form and rise until the powder all disappears. How does water affect baking powder?

How do you think the moisture in the dough will affect the powder in it? Will the bubbles rise through the dough as they do through the water? What effect will they have upon the dough? Why should the baking powder be mixed thoroughly with the flour? What makes the bread light?

If convenient, make some small baking powder biscuits and bake them on the stove in school. Note change in size while baking. Why should baking powder be kept cool and dry? Lead pupils to make a recipe for bread making, or write a description of how it is done.

Visit a bakery, and note how uniform are all the proportions of the ingredients used, the temperature of the oven, the time required to bake the bread, the cleanliness of the workmen and utensils used, the uniform weight and shape of the loaves, etc., and how the public is served with bread.

LESSON XXXIII

WHEAT CONSTITUENTS

Experiment 1. — Add a few drops of tincture of iodine to some starch stirred in water. Note the purple color. This is a test for starch. Pulverize wheat and other seeds, scrape a potato or turnip, etc., mix with water, and test these substances for starch.

Test a small piece of bread in the same way.

Explain that starch forms a large and necessary part of our foods, and is very abundant in wheat and flour and bread, as well as in many of our vegetables and in some of our fruits.

Experiment 2. — Wash in water for a long time a piece of dough made from wheat flour. Chewing for a long time a mouthful of wheat will produce the same result. When all the starch is washed out, a gummy substance is left. This is mostly gluten, and is useful food. This is also what makes the dough tough or tenacious and holds the gas made by the yeast, making the bread light.

Experiment 3. — Explain how the gas bubbles in the yeast are caught and retained throughout the loaf by the gluten in the dough. Make some soap bubbles. Compare the action of the gluten with the office of soap in making soap bubbles.

Baking powder acts in a similar way. Bicarbonate of soda mixed with an acid like cream of tartar, when moistened, will emit the same gas.

This gas, however, is mostly driven off in baking, but not until it has made the dough light, and the heat has made the loaf rigid.

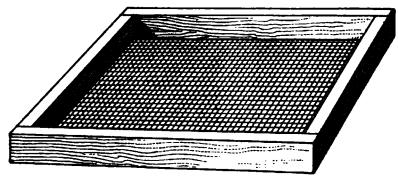
LESSON XXXIV

FLOUR AND FLOUR MAKING

From what is most of our flour made? Show samples of flour, corn meal, etc., and discuss them. What part of the kernel furnishes the white flour? the bran? the middlings, or shorts?

Explain what "self-raising" flour is, and how this may be prepared at home.

Experiment. — Grind some wheat in a mortar or coffee mill. Get the children to suggest how the resulting ingredients — bran, shorts, and flour — may be separated. Sift through sieves of different degrees of fineness, or through cloths, and show how the flour and other products may be separated from each other.



A Simple Sieve

Visit a flour mill, and show how the grists are received and weighed, passed through a smut machine, and the grain cleaned from other substances, and how it is then passed into the grinding machine, the mill stones or rollers, and crushed. The means of separating the different ingredients, and of making the different grades of flour, may be seen and explained to the children. Show them how the flour is finally put into sacks and properly branded and shipped to reach the consumer.

Note. — For a few cents, small pieces of wire cloth having meshes of different sizes may be purchased. Some of the older pupils can make of them very useful sieves as shown in the illustration.

LESSON XXXV

FARM ANIMALS — THE HORSE

Mention all the useful animals seen on the farm. Make a list of them. Which is the most useful? Discuss the horse; the many kinds of work he does; the food he eats; the care he should receive; his disposition and intelligence. Many stories and anecdotes are told to illustrate these topics. Several lessons may be given on this subject.

COACH HORSE

Horses may be divided into four classes, according to the work they do: (1) those valuable for speed; (2) draught horses; (3) coach horses; (4) ponies. Notice how each is built and adapted for the uses made of him. How fast can a horse run? Describe his walk; trot; pace; gallop. Is the horse useful for other things than the work he does?

DRAUGHT HORSE

What use is made of horsehair? Is his flesh ever eaten? The skin of the horse is often tanned into leather.

NOTE. — A few suggestions concerning the care and treatment of the horse should be given to pupils. Do not whip a frightened or balky horse: kindness is generally more effectual than cruelty. Keep his feet well shod. A good currying equals a feed of oats. In cold weather blanket a horse when you tie him up; and never let him drink cold water when he is very warm.

LESSON XXXVI

FARM ANIMALS — THE COW

The cow is useful to man in so many ways that it will require several lessons to teach this subject and to attend to the appropriate activities connected with it.

If possible, visit the barns of a dairy and see how the cows are sheltered, fed, and milked. Note the order and cleanliness observed, and the care given to the milk.

It may even be possible to get the consent of the owner of a cow to bring her to school, where she may be milked by one of the pupils in the presence of the others. The milk may then be taken into the school and allowed to stand in a cool place until a thick cream is raised. Remove this and make into butter by stirring it in a bowl. If some of the milk "sours," make it into cottage cheese, by heating and draining. In connection with these activities the processes of making butter and cheese may be explained, and to illustrate the work some small bottles of uniform size and shape may be filled with the products as they are studied. Attach these to a heavy cardboard, and they will make a most useful chart. Thus a bottle of milk, one of butter, and a third con-

taining cheese may be attached to the card by the time the work reaches this point. A drawing of a cow by one of the pupils may head the chart.

The above-mentioned products are the chief products of the living animal, but the cow furnishes us also with meat and tallow. Visit a meat market, and note how a beef is dressed and cut up for sale. Note the various cuts and their relative prices. Mention some of the forms in which meat is sold, *e.g.* fresh, corned, dried, sausage, bologna, etc. Add to the chart a small bottle of chipped beef. In like manner, study suet and tallow and their uses. Tell about the old-fashioned tallow candle, and how it was made. Make some by "dipping," if there are no candle molds to be had. Attach in a suitable place a candle to the chart.

A Typical Beef Cow

Discuss the uses to the cow of her horns; also the uses to which man has put them. Combs, buttons, handles of various kinds, and other things are made of horn. Place one of these articles, or a horn, upon the chart.

In like manner explain the many uses of the bones and the things made from them, adding a bone button or similar object to the chart. Neat's-foot oil, glue, rennet-tablets, and gelatine may each in turn be discussed, and a sample in bottles added to the many other useful things obtained from the cow. If the teacher cannot obtain all the things mentioned,

surely a sufficient number of them can be had in almost any school to make a series of very interesting lessons.

Which breed of cow is, perhaps, the best for milk? Mention some breeds valuable chiefly for beef.

LESSON XXXVII

FARM ANIMALS—MISCELLANEOUS

In a similar manner lessons may be given on the sheep, the pig, the chickens, the ducks, the turkeys, illustrating them with suitable pictures or specimens, and developing the desirable qualities of the different animals for the various purposes that they serve, their care and the uses of each.

If a farm has been visited by a class, it will be an easy matter to make an interesting lesson on each of the useful animals seen there. With the use of good pictures and stories, much valuable information may be given and a correct attitude toward the animals be established in the minds of the pupils.

LESSON XXXVIII

FARM ANIMALS—FOREIGN

What animals does man use on the farm in other countries? Show pictures of the elephant, reindeer, llama, camel, etc. Discuss their structure, size, food, movements, intelligence, and usefulness, and bring out how each is adapted to the climate and conditions in which it lives.

With the aid of pictures and stories, show the care given them and their great usefulness. Compare them with our own domestic animals in various particulars.

This work will correlate with geography; the number of lessons to be given to it must be determined by the teacher.

THIRD GRADE — SPRING WORK

LESSON XXXIX

FOOD AREAS OF OUR NATIVE BIRDS

To teach some of the wonderful ways in which animals are adapted to subsist under all kinds of conditions, a study of our native birds in respect to their various food areas will prove very interesting. For this purpose it will be convenient to group the birds according to the geographical areas that they occupy, since surface conditions influence so greatly their food supply and methods of obtaining it.

These food zones, extending from the shores of the ocean or of the Lakes to the crest of the Rocky Mountains, may afford us the basis for making the following groupings of birds, which should be worked out by the class: —

1. *Water Birds*, as the seagull, pelican, duck, goose, etc.
2. *Marsh Birds*, as the heron, crane, snipe, killdeer, woodcock, etc.
3. *Lowland Birds*, as the meadow lark, blackbird, robin, woodpecker, kingfisher, etc.
4. *Highland Birds*, as the sage hen, quail, bluebird, grouse, owl, etc.
5. *Mountain Birds*, as the eagle, hawk, pine hen, magpie, crossbill, etc.

While few, if any, of these birds are strictly confined to the areas which may be assigned them, this method of grouping them will prove convenient and instructive.

To illustrate the work, induce the pupils to bring from their homes, or from the game market, samples of feathers, eggs, nests, heads, and feet of birds studied. Both teachers

and pupils will be somewhat acquainted with birds of each of these groups, and a further study of them in this light will add much to their interest in them as well as to their fund of information. The teacher will add such other birds mentioned as are seen by her pupils, placing them in their proper groups.

LESSON XL

FOOD AREAS — WATER BIRDS

Mention the birds which frequent the waters of the lake region. Make a list of such as the pupils furnish. Let them describe peculiar features of each bird mentioned. Have pictures of as many of them as possible for use in the class. Study in detail one or two species as types, selecting the ones most familiar to the pupils, or such as can be studied best by means of specimens or pictures at hand.

What is the general shape of all these birds? Why are their bodies boat-shaped? What other provisions for swimming are found in their structure? Discuss their webbed feet and short legs, and their position near the rear of their bodies; their waterproof feathers, and how they are kept impervious to water, etc.

Do they need to fly far? Why? Discuss their powers of flight; the length of their wings; the weight of their bodies; size and strength of the muscles which move the wings, etc.

Are they adapted to walk on land? Consider their short legs, clumsy feet, unsteady gait, slow progress, etc., when on land. What is their chief food? Do they find any considerable amount of food when on land? Compare the swiftness of flight to their slowness in walking, and discuss the greater need of the former.

Study in detail the duck. What is the color of the duck?

Is its color any protection? Describe its beak and the uses made of it. Show how it strains its food from the mud in which it is obtained. Consider the feathers and how they are kept oiled; the strength of the wings and the rapid flight; the food-getting habit; the nesting and rearing of the young; its noisy flight and annual migrations; its disposition and gregarious habits, and the ease with which it may be domesticated.

Consider also the game law as related to the duck, and account for the provisions it contains. Tell about hunting ducks. How may they be reared in a profitable way? Relate anecdotes about ducks.

LESSON XLI

FOOD AREAS — MARSH BIRDS

What is a characteristic of most birds that get a living in shallow waters? Why are they often called waders? Make a list of all the waders that the pupils have seen or can mention. Describe their feet. Their long and widespread toes are adapted to what purpose? Compare the length of their necks to those of water birds, or swimmers, and harmonize each with the needs of their respective owners. What do the long, sharp bills of most of them tell us about the food that they subsist upon?

The blue heron is found in our marshes and river bottoms, and is a typical "wader," as is also the crane. Most of the pupils will have seen these birds either on wing or in water. They migrate and travel in large numbers, especially the cranes, which are remarkable for the precision of their lines of flight and peculiar cry. Herons are found in all parts of the world, and are usually of large size.

Among the smaller waders may be mentioned our common snipe and killdeer. Why is the latter so called? Why do we often hear its shrill cry several times before we are able to locate it on the naked shores of a lake or marsh? Describe the nest and eggs of the killdeer. Discuss its food area. Some snipes have nerves in their long, slender beaks, that they may feel the larvæ, etc., buried in the soft mud into which they thrust their bills in search of food.

Of what use are the wading birds to man? What insects and other animals do they eat? If not destroyed, what would be the increase of these animals? A single toad will often lay more than 10,000 eggs in a season. Many other animals, also, are very prolific. A perpetual plague of frogs would prevail in marshy lands were it not for the appetites and ability of these wading birds.

Many stories are told of these wading birds, especially of the stork, which belongs to this class. It has, however, become almost thoroughly domesticated in some countries of Europe.

LESSON XLII

FOOD AREAS—LOWLAND BIRDS

Make a list of the birds found in our farming lands. They will include many of the perchers and some of the climbers. These birds live mostly in trees, and show considerable skill in making their nests.

The robin is a very common example of these, and may be studied in detail. Have the children describe him and discuss the following points: the size, shape, and evident use of the bill; his food supply; his feet and their adaptation to arboreal life. Describe his flight. Does he walk

or hop when on the ground? Does he do man more good than harm?

It is supposed that birds can both see and hear far better than man, and are thus better able to get their food. The small seeds and insect eggs appear much larger to them than to us, or they would not be so clever in finding them. A pair of robins may raise a dozen young ones in one season, and, when young, they are so ravenous as to eat nearly their own weight in food in a day. The immense number of harmful insects thus destroyed can scarcely be calculated, but surely the robins pay us well in this way for the few cherries that they may eat later.

The woodpecker is almost as common as the robin, and his peculiar food area demands a far more unique structure. Describe and note the adaptation of his feet and tail feathers for climbing and resting against the trunk of a tree; his sharp, pick-like beak to penetrate the bark; his barbed tongue to pierce and withdraw the larvæ he loves so well; his acute sense of hearing as he taps on the bark to frighten his prey, and then listens to hear it move within so that he can locate it exactly.

LESSON XLIII

FOOD AREAS — HIGHLAND BIRDS

Upon bench lands, or uplands, are often seen the quail, mourning dove, sage hen, grouse, bluebird, and one or two species of the sparrow family. What do most of these birds eat? How do they get their food? Why are some of them called scratchers? Many of them are related to our domestic fowl, with whose habits of scratching all are familiar. Study in detail the quail, or partridge.

Do all these birds migrate? Why not? Consider their powers of long flight; their ability to endure cold; their food supply, etc. Discuss their enemies and means of protection. Their beaks indicate what as to their natural food? How are their feet and toes adapted for the work of uncovering their food? How do they build their nests? What number of young may a pair rear in a single season? Which birds are considered game birds? Are they protected by the game law? Can they be tamed easily? Discuss their habits and disposition.

LESSON XLIV

FOOD AREAS — MOUNTAIN BIRDS

What birds are found in our mountains? Make a list of them upon the blackboard. Procure pictures of as many of them as possible. Stories, also, may be used in illustrating the habits and peculiarities of these birds. They include eagles, hawks, owls, magpies, pine hens, crossbills, and many others.

Which of these are birds of prey? On what do they prey? Tell what you can of their food habits, and how their bodies are adapted for their mode of life.

Which eat seeds or fruit? Which go in flocks? Are any mountain birds songsters? Have any of them brilliant plumage? Which are useful to man? Are any of them injurious to man?

Discuss in detail one or more of these birds.

What forms the food of most of these birds, especially of the larger ones? Do they migrate? To what extent does the cold weather affect their food supply? How are they adapted to endure the winter?

Discuss the carnivorous birds in relation to their prehension of food. The long and lofty flights of eagles and hawks; their wonderful powers of sight in searching for prey; their methods of dropping on to it when found; the shape and use of the bill and strong talons; the good and the harm done by these birds to man, are all interesting points to bring out by description or story, and by proper questions.

The structure and habits of the owl are of peculiar interest, and the following facts may be brought out concerning him: his feathers are soft, and his flight is silent, for he is nocturnal in his habits; his eyes are constructed to see at night, and he feeds upon such animals as he can find by swooping along the ground; his prey is swallowed entire, the indigestible parts being thrown up later. Owls mate for only a short period, and are essentially solitary in their habits. Some burrow in the ground to make their nests.

LESSON XLV

ANNUALS, BIENNIALS, AND PERENNIALS

What plants live but one year? Make a list of some of them. How do they manage to perpetuate themselves? Discuss the dangers to their seeds and how they are protected. Get samples of both wild and cultivated seeds. Why do plants produce so many more seeds than can possibly grow? Consider how man takes advantage of this habit in plants to provide for himself food, etc.

Discuss the seed coverings used for protection, *e.g.* stone fruits, the impervious varnish on some seeds, the pod, bur, etc., on others.

What plants live two years and then die? Make a list and collect samples of such. How large do they grow the first year? When do they bear their seeds? What preparation do they make for bearing seed? How does man make use of this habit? What change usually takes place in the plant while the seeds are developing? Account for it. Study some common root crops of biennials, as the carrot, beet, turnip, etc.

What plants live many years? Make a list. Describe the elaborate preparations they make to withstand the winter. Most of them do not bear seeds for several years while they are developing large and strong woody roots and trunks and branches, and protecting them by a thick bark coat. Consider also the preparations they make for each succeeding winter, developing anew buds and leaves and blossoms each year.

How does man take advantage of the habits of perennials to provide for his welfare?

LESSON XLVI

THE SUGAR BEET

If the school is near a sugar-beet farm or a sugar factory, a special study should be made of this industry. A visit to the farm or factory, or both, would form the best foundation for the work. Let the children describe the planting of the seeds and the machines used in doing it. Call attention to the care taken to secure good seed and to avoid wasting any in planting.

The seeder places the seeds in the best position to grow, so that as many as possible of those planted will develop. Consider the slope and direction of the rows and how they may

be irrigated. When and why do they need thinning? Why not plant fewer seeds and avoid the work of thinning? Describe the care and harvesting of the crop; the care given to those beets which are left to produce the seeds. How is the best seed procured?

An explanation of the different processes of making sugar should follow, providing the children can visit a sugar factory, but a verbal description alone will do little good, and if given at all, should be brief and general.

LESSON XLVII

CARE AND CONDITION OF THE SOIL

Dig a hole in the ground and collect from various depths samples of soils, and place them in proper order in a glass bottle. Why is the top soil of darker color than the subsoil? What influence does decaying vegetable matter usually have upon soil? The mass of roots of grass and other plants usually penetrate only twelve or eighteen inches, and in many places this determines the thickness of the loam.

Which absorbs more heat, a light or a dark color? Illustrate with many samples, and if possible with an experiment.

A piece of white and a piece of similar black cloth laid on top of the snow will show this in the winter time. The snow will melt much more rapidly under the black cloth.

Why are white hats and clothes worn in summer and dark ones in winter? What influence, then, does dark soil have upon the crops planted in it?

Discuss conditions of soil as to fineness, looseness, softness, etc., and the influence of each upon germination and plant growth. How do we make ground loose and fine?

Discuss plowing and harrowing methods and the object of the work.

LESSON XLVIII

A SCHOOL GARDEN

Each year the pupils should plant and care for a school garden. In beginning this work, use the suggestions in

ONION PATCH

This onion patch is a part of the Utah Normal Training School garden.

Lesson XLV, First Grade, as far as practicable. From year to year the seeds may differ, and the purpose of keeping the garden be changed somewhat.

Discuss with the pupils each spring the work to be undertaken, the seeds to be planted and the problems to be studied. During one season special attention may be given to the preparation of the soil and its effects upon the yield. At another time methods of planting various seeds may be

studied. Experiments in the cultivation of various kinds of flowers and their relation to insects may be conducted. Many plant relations to light, heat, and moisture may also be shown in a school garden, under the guidance of the teacher.

Is a level garden better than one that slopes? Why? Is a steep slope detrimental to a garden? How is the garden supplied with moisture? Why is the ground first plowed or dug up? Why is it harrowed or raked? What would be the result of planting seeds without first properly preparing the soil? What care does the garden need after planting?

Whence come all the weeds found in the garden? Recall work done on distribution of seeds. Why are weeds detrimental? Make a study of some of them. Which thrive and which do not? Why? Do weeds serve any useful purpose? When is the best time to destroy weeds?

Many problems will arise and new things will be learned almost every day in watching and caring for a garden.

LESSON XLIX

HOW TO PLANT

Depth. — What seeds may be planted deep? What seeds would not come up if planted deep? Are there any reasons to guide us as to depth in planting seeds? What seeds contain much food in proportion to the size of the plant? What seeds contain little food for the plant? Which plants have slender, spear-like stems? Which have blunt or tender stems, ill adapted to penetrate a deep overlay of soil?

Wheat, corn, and many other grains may be planted deep, but melon, squash, etc., and the small seeds like lettuce and most flower seeds should be planted shallow, for reasons indicated in the above questions.

Distance Apart. — Which seeds are commonly planted broadcast? Why? What are the size and habits of growth of these plants? Mention some that are planted close together, but in rows some distance apart. Discuss the method as adapted to the nature of the plant, the care it requires, and convenience in gathering the crop.

Mention some seeds that are planted in hills close together and some in hills wide apart. Give reasons in each case.

NOTE. — Usually tall, slim plants, with few or no branches, like the grasses, are planted close together. Corn does better in hills, so that it can be cultivated both ways, but requires more space than the grasses and small grains; while the gourd family have widely spreading vines that need much ground space.

LESSON L

PLANTS NEED HEAT

In what month do plants begin to grow? Why? When do they cease to grow? Why? Compare from your temperature record the average temperature of November and April. Compare the plants on the north side of the house with those on the south side in early spring. Account for the difference in size or development.

Where is vegetation earliest and most luxuriant, in lower valleys, upper valleys, or on high mountains? Compare the temperatures of these places. Where does the snow last longest? Account for the vegetation in the different zones as influenced by the temperature.

In which month do our trees and most other plants make the greatest growth? Measure growing twigs during the summer months and determine this from actual observation, and test.

LESSON LII

PLANTS NEED LIGHT

Describe plants grown in a dark cellar. Bring samples of sprouting onions, potatoes, cabbage, etc., or prepare beforehand a chalk box in which wheat has been planted and is growing, but which has been kept under a tin bucket or other covering to keep out the light while it has had plenty of heat and water.

BEAN LEAVES TURNED TOWARD THE WINDOW

Why is grass that is grown under a board or other covering so pale and delicate? Why are house plants set in the window? Which way do most of their leaves turn? Account for the sunflower's name. Discuss its habits in relation to light. Why do flowers close at night and open in the morning? Compare the grass under the low boughs of an evergreen tree on the lawn with that which receives direct sunshine.

Can you give any reason why the branches of a tree leave the trunk on all sides? Is there any reason why the leaves on a twig are not all attached to the same side of the twig? Look at a tree or large plant and note how the branches and leaves are so distributed as to get for each leaf some sunlight at least once a day, as the sun passes over it from east to west.

Note the relation of the strong and the weak branches to the sunlight that they receive. Where is the best fruit found on a tree? Why?

LESSON LIII

PLANTS NEED MOISTURE

When do we have the most rain? What influence has this upon wild vegetation? Where is wild vegetation more abun-

EFFECT OF MOISTURE UPON GROWTH OF TREES

The trees in this row were all planted at the same time, in soil that is sandy and uniform. They are irrigated by a small stream running from left to right. Most of the water soaks in before the last trees are reached; the growth is in proportion to the moisture received.

dant, on the hill, or in the valleys? Account for this. Why do irrigating ditches so soon become clogged with vegetation? Give many illustrations of the effects of much moisture and of little moisture. Deprive a plant of water for a short time, and note the result. Show the difference in size between a plant grown with plenty of water and another of the same kind grown with too little.

Describe artificial methods of supplying cultivated plants with water. Describe how our mountain streams are diverted into canals and conveyed in ditches to our gardens and farms. Compare this labor and expense with farms irrigated wholly by rains.

Do rains fall sufficiently regularly to insure the growth and development of crops? Discuss results of too much rain and of too little rain. Is there a recompense for the extra expense and labor of irrigating?

LESSON LIV

INFLORESCENCE

Place some apple, pear, or cherry twigs bearing flower buds in a jar of water, and have the pupils watch them while the buds develop. Note the calyx and the office that it performs for the tender bud. When its labor is over, its members, the sepals, curl back and become inconspicuous.

Note the development of the corolla; the unfolding of the petals. Of what use are they? Why are they so brilliant?

Have you ever noticed bees and other insects flitting from flower to flower? Note the odor, also, and the honey or nectar which the bees like so well. Encourage the children to watch carefully for a week or ten days the changes in a chosen cluster of blossoms on some convenient tree.

Call attention to the stamens and the pollen box at the end, and show how this pollen is scattered by insects. Study the pistil and the ovary and the development of the latter into fruit. This work should be mostly observation work and the pupils should be required to discover the uses of the four principal parts of a flower, and what becomes of each as soon as its work is done.

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